Chemical Lib
JAN 15 1917
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VOL. 15. NO. 1 Registered in U. S. Patent Office JANUARY, 1917

THE METAL INDUSTRY

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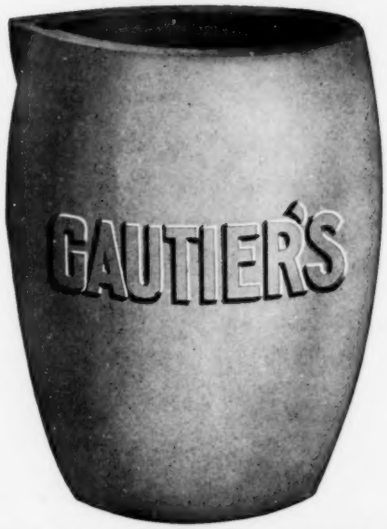

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ELECTRO-PLATERS REVIEW.

OLD SERIES Vol. 23. No. 1. NEW YORK, JANUARY, 1917. NEW SERIES Vol. 15. No. 1.

THE MANUFACTURE OF SEAMLESS TUBES

A BRIEF DESCRIPTION OF THE PRODUCTION OF SMALL IRON PIPE SIZES OF METAL TUBING.

BY L. J. KROM.

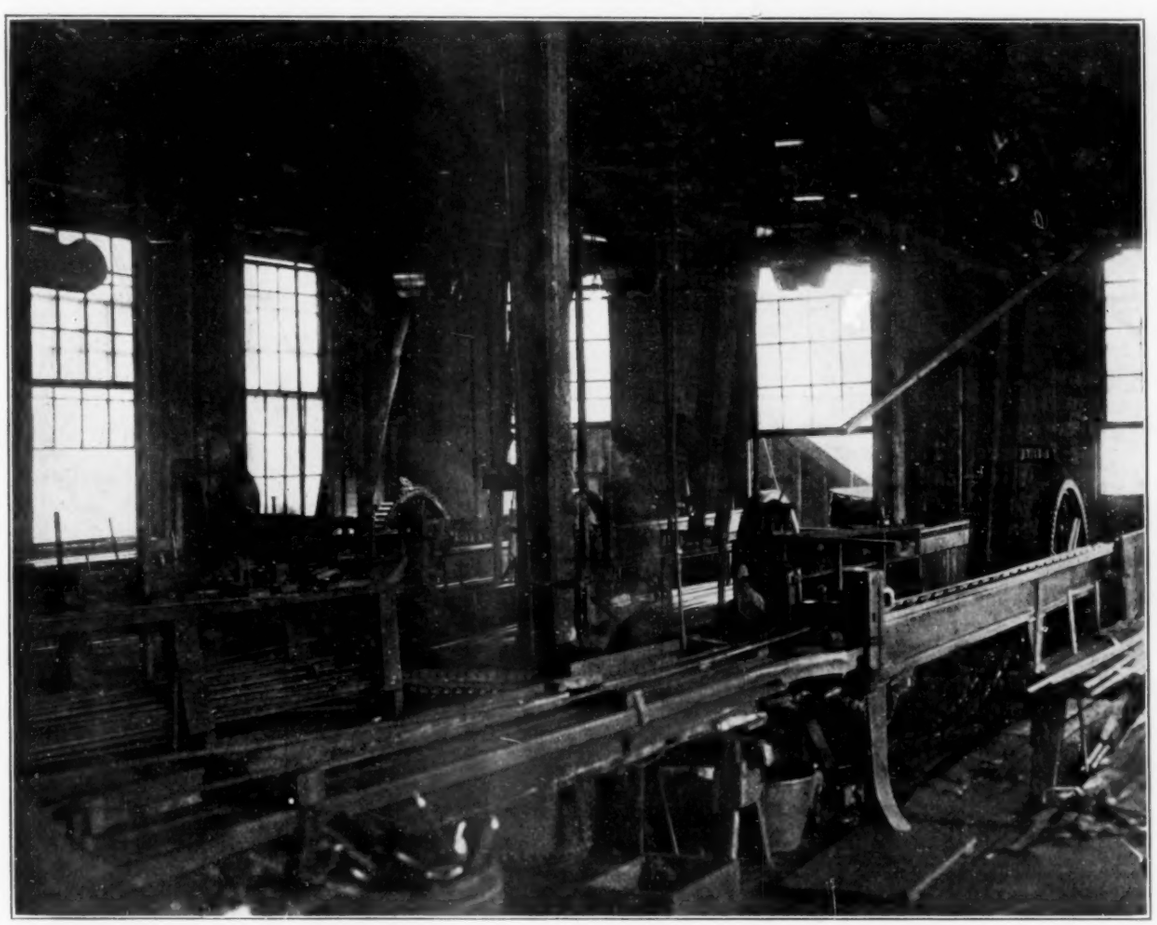
As has been said[1] there are five methods at present employed for the manufacture of seamless copper, brass and aluminum tubes. It may be interesting to repeat briefly these methods here.

1. The most common method is to cast the metal as a hollow billet using a destructible core and then draw the resulting rough casting to the gauge and size required.

2. The metal is cast in a solid billet and then a revolving mandrel is forced through the center. This is known as the Mannesman process.

3. A solid cake of metal is cast and then rolled to a certain gauge. A disc is then cut out and a series of drawing operations forms a tube.[2]

4. The metal is poured molten into the container of a machine and revolved very rapidly forming a tube by centrifugal force.[3]



A VIEW IN A BRASS AND COPPER TUBE MILL, SHOWING DRAW BENCHES FOR DRAWING DOWN TUBES

5. By extrusion. A solid billet is heated and forced through a die by hydraulic pressure. This, so far as I know, is applied only to aluminum, tin and lead tubes, but numerous attempts have been made to make copper and brass tubes in this manner.

[1] THE METAL INDUSTRY, August, 1913.

[2] THE METAL INDUSTRY, August, 1913; November, 1916.

[3] THE METAL INDUSTRY, April, 1914.

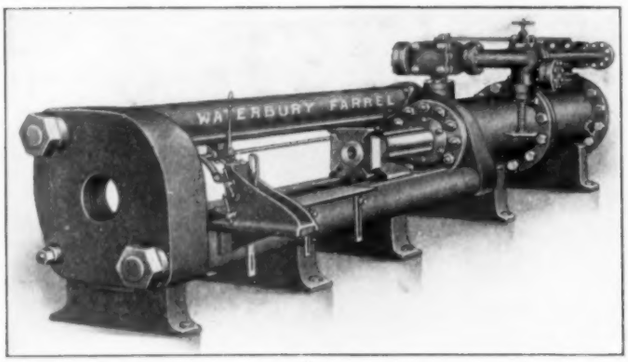


FIG. 2. A SEAMLESS HYDRAULIC DRAW BENCH MANUFACTURED BY THE WATERBURY FARREL FOUNDRY AND MACHINE COMPANY, WATERBURY, CONN.

they are worn out by breaking or the wall gets too thin to stand the pressure.

THE CORES.

The core for seamless tube castings is known as destructible and is made as follows: A good grade of fire clay is ground in a mixer as shown in cut with water until it has the consistency of soft putty. An iron pipe about an inch in diameter is then taken and bored full of small holes. The pipe is then coated with alternate layers of clay and meadow hay, preferably salt. The difference between the outside diameter of the core and the inside diameter of the mold determines the thickness of the wall of the tube casting. The core after being made is coated with a wash made of whiting and water for brass tubes and of graphite and water for copper and is then baked in a core oven until hard.

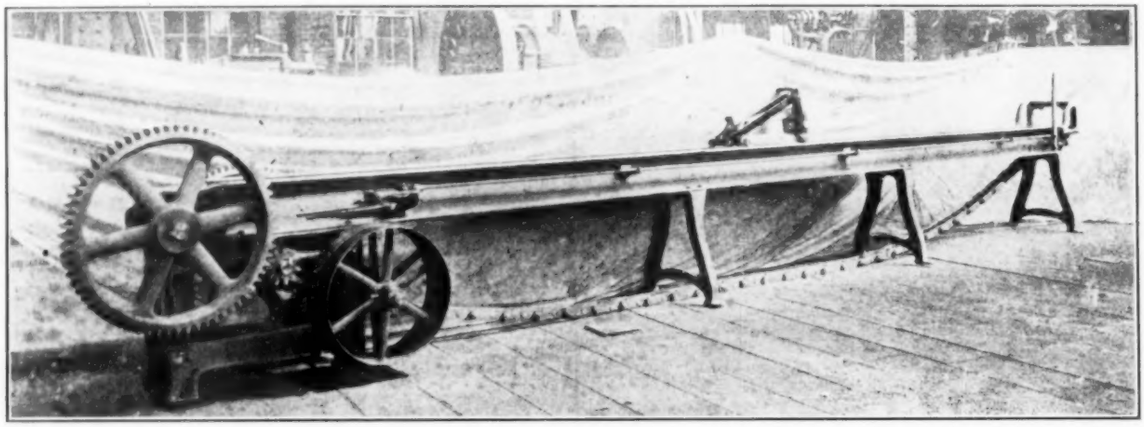
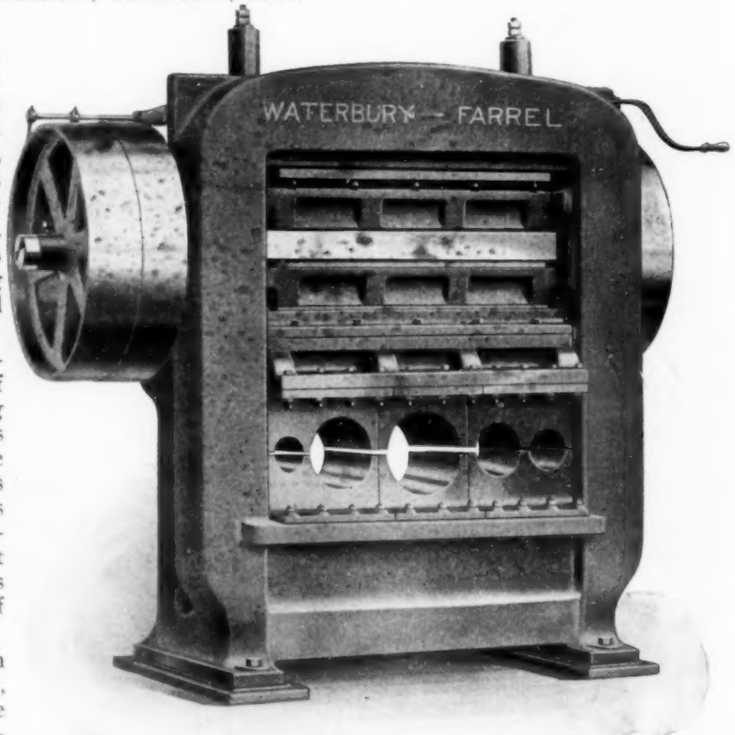


FIG. 3. A CHAIN DRAW BENCH FOR DRAWING SEAMLESS TUBES MANUFACTURED BY THE WATERBURY FARREL FOUNDRY AND MACHINE COMPANY, WATERBURY, CONN.

Copper tubes are now being extruded by a different method from that used for rods and soft metal tubing. A billet of copper is cast in an iron mold direct from the refining furnace. The billet may weigh as much as 150 pounds, it is usually about 8 inches in diameter, 10 inches long and has a rounded end. The billet is placed in a holder with a closed bottom in a very heavy press and a plunger is forced down through the billet. The metal in the center is thus forced out to the sides and is then squeezed up to envelop the plunger making a tube. This tube is then reduced in size and increased in length by the usual drawing down process.

Only the first method outlined above will be described here as the intention is to give an account of the making of small tubes. The largest size casting that is usually made for producing small seamless tubes is five inches in diameter. This is partly due to the fact that it is difficult to cast sound copper castings larger than this and also to the fact that larger tubes are made more cheaply by some one of the other methods mentioned. So then, I think, I may safely say that all seamless copper and brass tubes from two inches in diameter down are made from hollow castings. If this is not so I shall be glad to be corrected.

The metal is melted in crucibles in pit fires with coal or coke or both and then is poured into iron molds, which are known as cannon molds. These molds are made of gray iron billets and are bored out inside perfectly smooth to the required diameter. They, of course, become larger in diameter as they are used and are utilized for larger and larger castings until



A SEAMLESS TUBE POINTING MACHINE, MANUFACTURED BY THE WATERBURY FARREL FOUNDRY AND MACHINE COMPANY, WATERBURY, CONN.

The mold is fitted at one end with a bushing into which the protruding end of the core pipe fits. The bushing is held in place by a pin passing through the side of the mold. In order to hold the core central, a collar is placed on the top of the mold. This collar has four lugs which fit into the inside of the mold. A pouring basin is then placed on top of the mold and the metal is poured into it and thus fills up the space between the core and mold and this makes the tube casting. The molds are dressed just as in the casting of strip or slab castings, with graphite and an oil having a high ignition point and good body such as lard, fish, or heavy cylinder oil.

After the metal has set in the mold the pouring basin is taken off—the mold lowered to the floor or if it swings on trunnions is is swung out horizontally and the tube casting is drawn out from the pouring end or top of the mold. The core is then either hammered out with wooden mallets or forced out by hydraulic pressure. The inside of the casting is cleaned out with water, the shrink head is cut off and the tube is ready for mechanical treatment.

The first operation on the tube after it leaves the casting shop is, in most mills, that of annealing. That is, the tube is placed in a muffle furnace and slowly heated to a cherry red heat and then allowed to cool. This operation usually is done at night so that the tubes are ready for the draw benches in the morning, but where a mill runs twenty-four hours nothing is gained by the first annealing, except that the tube is a little softer and some larger reductions may be taken than with an unannealed tube. On the other hand, the annealing causes a loss in five to six hours in operating time, so there is a question as which is the better practice. We have mills in this country that do it both ways. After annealing, the tubes are pickled in the regular sulphuric acid and water pickle (one part of acid to eight of water). After washing they are then "broken" down. This means passing through a breaking down machine which is a hydraulic draw-bench or ram shown in the cut Fig. 2. Following the breaking down operation comes the regular annealing and pickling and then a series of "draws" upon the running down and finishing draw benches as shown in Fig. 3.

A typical series of reductions as performed on a two-inch iron pipe size brass tube down to a finished size of say one-eighth inch inside diameter or a number 24 Stubs gauge would be about as follows:

2	3/8	inch	O.D.	2	1/16	inch	I.D.	5/32	inch	wall	Soft	anneal	and pickle
2	1/8	"	"	1	7/8	"	"	1/8	"	"	"	"	" "
1	7/8	"	"	1	11/16	"	"	3/32	"	"	"	"	" "
1	21/32	"	"	1	1/2	"	"	5/64	"	"	"	"	" "
1	7/16	"	"	1	5/16	"	"	1/16	"	"	"	"	" "
1	7/32	"	"	1	1/8	"	"	3/64	"	"	"	"	" "
1.021		"	"		15/16	"	"	19 Stubs gauge			"	"	" "
.882		"	"		13/16	"	"	20	"	"	"	"	" "
.749		"	"		11/16	"	"	21	"	"	"	"	" "
.618		"	"		9/16	"	"	22	"	"	"	"	" "
.487		"	"		7/16	"	"	23	"	"	"	"	" "
.419		"	"		3/8	"	"	24	"	"	"	"	" "
	11/32	"	"	without plug									
	9/32	"	"	"	"	hard							
	7/32	"	"	"	"	"							
.169		"	"	"	"	anneal after finishing or final draw							

[This article concludes a series on the manufacture of wrought brass, plates, sheet-iron, wire and tubes which have been running in The Metal Industry since 1910. These articles are, as far as we know, the only ones ever published dealing with the practical manufacture of wrought brass.—Ed.]

CASE-HARDENING BRONZE FOR DIES

The bronzes which possess the greatest hardness lack the requisite properties for chasing and sinking fine intricate designs. It is, however, possible to obtain a hard face on a bronze by a process analogous to case-hardening of steel, and this is practised with some bronze dies.

The method is that of coating the surface of the die with pure tin, and then heating the die to a low red heat in order to alloy the tin with the surface of the bronze. As is well known, copper and tin unite in all proportions, and with from 20 to 30 per cent of tin the alloy becomes quite hard. The surface of the die to be case-hardened is cleaned from grease by soaking in a strong hot potash solution and then immersing in a pickle or dip of acid to remove the oxide.

A suitable pickle, which works more rapidly if hot, is made with five parts of water and one part oil of vitriol, and the die is allowed to soak in it for several hours until clean. It is then taken out and brushed, and the surface coated with a strong solution of chloride of zinc to act as a flux. The surface is then covered with pure melted tin. The tin may be melted on the surface by a soldering-iron, but by far the best method is to use a torch or a blowpipe. The tin is melted over the surface only, and as little as possible put on, as the fine detail of the die must not be filled up. The die is then washed in water to remove the excess of chloride of zinc flux, and the surface examined. If there are any portions which are not entirely covered with tin, the process is repeated.

The next operation is to heat the die to a red heat, preferably in a muffle, though a blowpipe or torch may be used. To prevent the surface from oxidizing, it is advisable first to cover it with a strong solution of boracic acid. Some boracic acid is dissolved in hot water, and the solution lightly brushed over the surface. A light coat only is necessary. The die is placed on an iron plate to keep it from breaking when heated, as tin-bronze becomes brittle at a red heat, and it is heated to a low red heat and allowed to remain in this condition for ten or fifteeen minutes. The plate is then removed from the muffle, and the die allowed to cool. The boracic acid is removed by soaking in hot water and afterwards pickling if necessary.

After these operations the surface of the bronze is quite hard, and difficult to cut with a file. Dies hardened by this method can be used for stamping leather, soft metals, paper, and similar work, as they can be made originally soft enough for chasing or sinking with ease, and then hardened without destroying the design.

The best results are obtained by using a rather soft bronze mixture with as little lead as possible. Such a bronze, high in copper, is not liable to give trouble by softening or cracking during the heating. A mixture recommended for this work is:—Copper, 88 lbs.; tin, 8 lbs.; zinc, 2 lbs., and lead, 2 lbs.—Exchange.

REFINING ZINC WASTE.

Scrap zinc cannot be refined in any simple and inexpensive way, although some of it may be recovered without much trouble. The scrap may be refined in three different ways—by distillation, liquation, and electrolytic deposition. The distillation method requires the use of a closed retort and condenser. The zinc skimmings and shot are mixed with zinc ore, and the zinc is then recovered and refined. The reverberatory furnace is used for the liquation process. This is a combination of the melting and separating processes, and it must be followed by distillation in order to produce the highest gradings of zinc.

The electrolytic process is probably the best if the work can be done on a large scale, but those who operate on such a scale are content probably with whatever method has proved most suitable in experience.

ALUMINUM ROLLING MILL PRACTICE

AN EXHAUSTIVE ARTICLE DEALING WITH THE WHITE METAL, ITS OCCURRENCE, PROPERTIES AND MODERN METHODS OF WORKING IT, SUCH AS ROLLING AND ANNEALING

WRITTEN FOR THE METAL INDUSTRY BY GEORGE LYON JR.

GENERAL CHARACTERISTICS OF ALUMINUM

Aluminum is the most abundant metal on earth, and it has been variously estimated that from 1/20 to 1/12 of the crust of the earth is aluminum. Of the elements which compose the crust of the earth, aluminum ranks third, being exceeded only by oxygen and silicon. It is found practically everywhere, but at present only the richest ores called bauxite are used, and until an economical method of reducing the low grade ores is found, aluminum is unlikely to be classed as one of the cheap metals.

Notwithstanding its abundance, aluminum was unknown until 1827, from which time until the late eighties, when the present methods of reducing the metal were patented, it was more or less of a laboratory curiosity. The world production of aluminum up to the year 1886 has been estimated at 115,000 pounds, at prices ranging from $90.00 per lb. down to $5.00 per lb. The production of aluminum in the United States in the year 1883 was 83 pounds at a price of about $10.00 per pound. Thirty years later in 1913, the consumption of aluminum in the United States was over 72,000,000 pounds, at prices varying from 26½ cents down to 18¾ cents per pound; and for 1916 the estimated consumption of aluminum in the United States is more than 100,000,000 pounds.

The properties of aluminum are such as to give it a wide and ever increasing use. Where strength is not an essential quality, aluminum is a valuable and most useful metal. It is silver white in color, has a brilliant lustre, is susceptible of a high degree of finish by polishing or burnishing, and does not readily tarnish in air at ordinary temperatures. It is soft, very malleable and ductile, highly sonorous, a good conductor of heat and electricity, non-poisonous, tasteless, and odorless. Unfortunately it has one undesirable property—it is attacked by alkalies.

For engineering purposes pure aluminum, at its best, is an uncertain metal, being too soft and lacking in mechanical strength. These weaknesses are partially overcome by alloying with other metals and for general engineering work, the alloys of aluminum are much more important than the pure metal. Where malleability or ductility is required the pure metal is generally used.

Whatever weaknesses aluminum may have they are more than compensated for by two unusual qualities, which that metal possess to a greater degree than any of the common metals. These unusual qualities are low specific gravity and large specific heat. Where lightness with a fair amount of strength, or the absorption or retention of heat are desirable qualities aluminum has no rival among the common metals.

Lithium, potassium, and sodium are plentiful, and with rubidium and caesium, which are rare, belong to the group of alkali metals. They are soft, readily fusible bodies, easily oxidized on exposure to air, and decompose water at ordinary temperatures. They have no valuable mechanical qualities.

Calcium, magnesium, glucinium, and strontium belong to the alkaline earthy group of metals. Calcium, and to a somewhat lesser extent, strontium are widely distributed. They are malleable, but quickly oxidize on exposure to air, and have no important mechanical properties. On account of their easy oxidization they have but little use in the mechanical arts, but are sometimes used as deoxidizers. Glucinium is a soft white malleable metal with many desirable mechanical properties. If produced in quantities, it could be a useful metal. Beryl, from which it is prepared, is a comparatively rare mineral, and it is unlikely that glucinium will ever be more than a curiosity.

Magnesium is found in abundance. It resembles aluminum in color, and has a lower specific gravity and larger specific heat. It has good mechanical properties, alloys well with other metals, and the magnesium alloys of aluminum are said to be as strong as the copper alloys of aluminum.

Its high price has prevented its more extended use; but with improved methods of reducing the metal, now being brought out, and consequent lower price, magnesium may soon be a formidable rival of aluminum and displace it in many ways. At present aluminum has no real competitor.

There are a number of metals with lower specific gravity and larger specific heat than has aluminum. These and the common metals are given in the following table:

Metal	Specific Gravity	Specific Heat	Melting Point F.°
Lithium	0.54	.941	367
Potassium	0.86	.170	144
Sodium	0.97	.290	207.5
Rubidium	1.53	.077	100
Calcium	1.57	.170	1490
Magnesium	1.74	.250	1204
Caesium	1.87	.048	79
Glucinium Berglium	1.93	.621	2462
Strontium	2.54	.074	1472
Zinc	7.15	.094	786.9
Tin	7.29	.055	449.4
Iron	7.86	.110	2786
Nickel	8.80	.108	2646
Copper	8.93	.098	1981.5
Lead	11.37	.031	327.4
Silver	10.53	.056	1761
Gold	19.32	.031	1945.5
Platinium	21.50	.032	3191
Aluminum	2.56	.218	1217.7

[The melting point figures, with the exception of Strontium, are taken from "Circular of the Bureau of Standards, No. 35 2nd Edition, Revised Jan. 1, 1915."

The melting point figure for Strontium and all the specific gravity and specific heat figures are taken from "An Introduction to the Study of Metallurgy," by Sir W. C. Roberts-Austin, Sixth Edition (1910). Revised and Enlarged by F. W. Harbord.]

PRODUCTION PROCESSES.

The different processes used in producing aluminum are mining, purifying or refining, calcining, and reducing. The molten aluminum is tapped from the reduction pots once every twenty-four hours into a small ladle and then poured into a larger ladle. Aluminum from several pots is mixed in the larger ladle and then poured into iron moulds for pig aluminum. The metal from each large ladle is kept separate and an analysis made. Metal containing not more than 45 of one per cent. of harmful impurities (iron and silicon) is classed as pure aluminum. With more than 45 of one per cent. of harmful impurities, the metal is used in making aluminum alloys. The pig aluminum is melted

in any of the many furnaces used for melting purposes and poured into slabs, ingots, wire bars, etc., as required. The pouring temperature is about 1400° F.

For ordinary sheet rolling mill purposes an ingot about 13x21x2 inches, tapered at one end to permit easy entrance between the rolls, and weighing about fifty pounds is used. The moulds stand on end, but differ in shape from those used for brass, in that the metal enters the mould on the side, and the gate extends the full length of the ingot.

ROLLING MILL ALLOYS OF ALUMINUM

The metals commonly used in alloying with aluminum are copper and zinc. Manganese alloys of aluminum have been experimented with lately and are considered satisfactory for both wrought and casting purposes. The copper alloys of aluminum are more largely used and it has been estimated that 90 to 95 per cent. of all aluminum castings are made of No. 12 aluminum alloy, aluminum 92, copper 8.

This alloy is too brittle to roll, and where a rigid aluminum alloy suitable for wrought purposes is required, one containing not more than 5 per cent. of copper is employed. More than 5 per cent. of copper makes aluminum practically unworkable.

In the rolling mill the alloys of aluminum are handled in much the same way as the pure metal, but require frequent annealing.

ROLLING AND ANNEALING

Aluminum is an ideal metal to roll. It is soft, very malleable, easy to handle, clean, requires little or no annealing, and if annealed no oxide or scale forms on it after cooling off, consequently no pickling or cleaning is required. A scleroscope test of pure aluminum is about 3 copper, is 6 brass (2 and 1) 14 and up. In malleability, aluminum ranks second among the common metals, being exceeded only by gold. An idea of the extreme malleability of aluminum may be gained by stating that for sheet aluminum 24 inches wide, .005 inches thick, finished in packs, it is commercial practice to hot roll to ¼ inch thick, and then cold roll to .005 without annealing.

The equipment in an aluminum rolling mill is similar to that in a copper mill but varies in details. Chilled iron rolls are used flat or slightly concave for hot rolling and crowned for cold rolling. The brass mill taper of .001 inch to a foot of length of roll gives satisfactory results in finishing.

The first mill equipped for rolling aluminum, had rolls 18 inches and 20 inches in diameter by 30 inches and 36 inches in length. The metal was hot rolled and after grinding the rolls, finished on the same mill. To-day rolls 30 inches by 120 inches are in use, 28 inches by 84 inches are common, with numerous others of various sizes for the different classes of work. A heavy mill gives best results. For hot rolling a speed of 200 to 300 feet per minute can be used; and for cold rolling up to 200 feet per minute.

Screws on hot mill are 1 inch pitch. A circular band, about 30 inches in diameter and divided into 200 equal parts, is attached to the head of one screw. Each division represents .005 inch in the turn of the screw, .010 and .050 are marked with longer dividing lines. A pointer indicates the distance the screw has been moved. The mill is equipped with a motor for operating the screws and raising and lowering the top roll. This gives both speed and accuracy in handling the ingots.

Screws on cold rolls are mostly of ¼ inch pitch. In the hot rolling and cold sheet rolling described, a mill 28 inches x 84 inches is used.

The furnaces used in heating for hot rolling and annealing are simple in construction and usually of the under fired type. They are equipped with pyrometers and burn oil or gas. The hot rolling temperature for aluminum is about 900° F. The annealing temperatures vary from 450° F. to 900° F., according to the metal and class of work. In annealing aluminum, a thick body of metal is loaded on an iron truck and run into the furnace.

The temperature is gradually brought up to the required point and held there for several hours, care being taken to see that the temperature does not get above the pre-determined point. Usually two loads are annealed in twenty-four hours. When pulled out the metal is allowed to cool off slowly.

The practice in hot rolling copper is to put a number of ingots into the furnace and after they are brought to the proper temperature to take them out one at a time and roll to the required dimensions.

In hot rolling aluminum about 25 ingots are put on an iron truck and run into the furnace. The heat is put on gradually, about 5 hours being allowed to bring the load of metal up to the proper temperature, after which it is allowed to soak for another hour. The truck with the 25 ingots is then pulled out of the furnace, taken to the rolls, and the ingots rolled one at a time to their required dimensions. Although a half-hour elapses between the rolling of the first and last ingot, aluminum retains its heat to such a degree that one ingot rolls as well as another.

The list of "pinches" below will give you an idea of the way aluminum is hot rolled. Ingot is 13x21x2 inches, and weights about fifty pounds.

For a strip to trim 12 inches. Ingot is rolled straight ahead:

1st pass to 1¼ inches.
2nd pass to ¾ inches.
3rd pass to ⅜ inches.

For sheets to trim 24 inches.

1st pass to 1½ inches.
2nd pass to 1⅛ inches. } (Widening passes.)
3rd pass to ⅞ inches. }
4th pass to ⅝ inches.
5th pass to ⅜ inches.
6th pass to ¼ inches.

For sheets to trim 36 inches.

1st pass to 1½ inches.
2nd pass to 1⅛ inches. }
3rd pass to ⅞ inches. } (Widening passes.)
4th pass to 9/16 inches. }
5th pass to ½ inches.
6th pass to ⅜ inches.
7th pass to ¼ inches.

The usual practice is to enter the ingot at one end of the mill and work across. The rolls are kept well moistened with carbon (kerosene) oil and care taken to enter the ingot where there is plenty of oil. If entered on a dry place, the ingot will stick to the roll.

From 35 to 50 ingots are rolled in an hour. The crew consists of 2 rollers, screw boy, and 1 man to hand on in front, and 3 or 4 catchers back of the rolls. The rollers alternate. If 3 catchers are used, 2 work while 1 rests.

(To be continued.)

CAUSE AND REMOVAL OF FIRE STAINS IN STERLING SILVER

A Description of How the Stains Are Formed and Removed.

Written for The Metal Industry by Oscar A. Hillman, Electro-Chemist, Attleboro, Mass.

Until a few years ago practically everything manufactured of sterling silver (except tableware) was given a heavy coat of lacquer before leaving the factory to keep the articles from tarnishing.

The lacquered silver was always a source of trouble and expense, as the lacquer was almost sure to become torn or scratched, leaving the silver unprotected. It did not take long for the naked silver to tarnish, necessitating the removal of all the lacquer before the little spot or lines could be polished or rubbed off.

At present the majority of retail jewelers have installed the necessary equipment to polish or refinish their stock and specify that articles made of sterling shall not be lacquered.

OSCAR A. HILLMAN

Under the old regime it was not unusual for the manufacturer to cover over the fire stain in the sterling articles by giving them a light silver plate, then finishing as usual, but this method cannot be used on articles that may be polished or pumiced several times by a more or less inexperienced workman, as he is almost sure to cut through the coat of fine silver, leaving the fire stain exposed.

The most satisfactory method is to remove the fire stain and apply the desired finish on the silver without plating.

As the appearance of the dark stains under a layer of pure silver is always disconcerting to the uninitiated, an explanation of how the stains get under the surface and how to remove them may be of interest.

FORMATION OF THE STAINS.

Fine silver melts at 954 deg. C. and if kept in a molten state for a little while absorbs approximately twenty times its volume of oxygen. When crystallization sets in and the melted silver begins to solidify, the oxygen is expelled again, leaving the silver in its original state. This proves that oxygen or any other gas does not unite with the silver to form fire stains.

Sterling silver is 925 parts silver and 75 parts copper. When it is heated to a dull red or over the copper in the outer surface is converted into black cupric peroxide (Cu O). Another layer adjacent to the outer layer is formed, in which the copper has been partially protected from the air. The imperfectly protected copper has been converted into the red cuprous oxide (Cu_2O).

As the sterling is expanded during the period of oxidization of the copper, when subsequent contraction occurs the layer of cuprous oxide is effectually sealed against the action of any dip or solution except those which have the power to dissolve the arresting silver.

Peroxide of copper is very slowly dissolved by nitric acid, but fine silver, sterling and cuprous oxide are highly soluble, so the usual method of removing fire stains is to remove the black oxide by pickling in a hot pickle composed of six parts of water and one part commercial oil of vitriol. After the sterling has been subjected to the action of the pickle it has a superficial layer of fine silver completely hiding the gray or red fire stains underneath.

DIPS USED TO REMOVE THE STAINS.

The layer of fine silver and the layer in which the copper has been converted into cuprous oxide is removed by dipping in a hot nitric dip made of 2 parts nitric acid and one part water. The nitric dip is a rapid and sure method of removing the stains, but as it leaves the surface of the metal matted and rough it should not be used for delicate work.

After the nitric dip has become heavily charged with silver and copper the fine silver is recovered as metallic silver by hanging strips of sheet copper or zinc into the dip. Nitric acid has a greater affinity for both copper and zinc than it has for silver, so the acid gives up its load of silver and becomes saturated with metal from the strips. The fine silver is washed with hot water, after which it can be melted as usual. The old dips should always be tested with muriatic acid before they are thrown away, as it sometimes happens that the nitric becomes passive and does not give up all its silver.

A dip that removes the black oxide and dissolves the silver sufficiently to remove the fire stains can be made by using eight parts of oil of vitriol and one part nitric acid. When using this dip great care must be taken to shake off all excess of water from the work, as this dip acts very slowly and gives off suffocating fumes its use is limited to delicate card jewelry. The silver is reclaimed from this dip by precipitation as chloride of silver by adding dilute muriatic acid. The old dips must be allowed to cool before the muriatic is added. The most practical dip to use for the ordinary run of sterling work is made by dissolving two ounces of bichromate of soda in three and one-half quarts of water for each gallon of dip. After the bichromate is all dissolved add a pint of oil of vitriol and heat as hot as posssible without boiling.

When the artcles are immersed in this dip they should turn dark until the fire is all out, then assume a dead white appearance somewhat similar to an electro deposit from an old solution. If the dip is too concentrated it will work so rapidly that the bichromate of soda becomes recrystallized and as the crystals stick to the articles and form a resist to the solution the work to be dipped will be badly etched or eaten.

Sometimes when the dip has stood idle for several hours a few flakes gather and float on top, but they do no harm, as they dissolve as soon as the surface is disturbed.

When the solution loses its red color and turns dark green it can be rejuvenated by adding common salt until the silver is thrown down. The silver chloride forms a heavy curd which settles to the bottom of the jar and does not interfere with the proper working of the solution.

Some platers make up a strong stock solution of bichromate and acid and add a little as soon as the dip begins to work slowly, but it is not the best method of using the dip, as it is likely to work rough. All work that is to be fire dipped should be freed from grease and black oxide before being dipped in the final solution.

BRIGHT DIP FOR STERLING.

After the fire stains have been dipped off, the articles are covered with a dead white or gray smut which can be removed by scratch brushing or dipping in a special solution that contains:

Water	3 parts
Nitric Acid	7 parts
Muriatic Acid	1 part

This bright dip for sterling leaves a bluish sheen, but the articles are usually bright enough to enamel or polish without scratch brushing. When melting silver that has been reclaimed from a fire dip it must be borne in mind that the copper is lost as it is, as said before only the copper that oxidizes, so the right proportion of copper must be added to reduce the fine silver to standard sterling.

RISING COSTS IN METAL MANUFACTURES

AN ARTICLE GIVING SOME MEASURE OF EXPLANATION BUT WHICH DOES NOT SUGGEST A REMEDY.

WRITTEN FOR THE METAL INDUSTRY BY W. H. PARRY, SUPERINTENDENT NATIONAL METER COMPANY, BROOKLYN, N. Y.

The Editor of THE METAL INDUSTRY has asked me to write an article on "How to Meet the Situation of Increasing Costs in Manufacture" and I must confess that I am entirely at a loss to find something to write about, particularly as applied to a brass foundry. When we know that the prices of all non-ferrous metals, whether new or old, are fixed by interests that are chiefly occupied in getting all the money they can possibly squeeze out of the manufacturers, it is not the time to even consider ways and means to circumvent their designs in the hope that by so doing one can keep pace with the exorbitant demands.

Then again the labor situation is such that no amount of reliance can be placed on the men who make up the foundry forces, more especially the unskilled help which, after all is said and done, is a very important factor in foundry management at present. All the devices that human ingenuity can think of in the way of increasing a foundry's output are naught if the men for operating them cannot be obtained or at least cannot be held after being hired. The conditions in the labor market are such to-day that no amount of persuasion and I was almost about to state no amount of money can induce men to stay long enough to become acquainted with their surroundings in a foundry.

A brass foundry that usually employs a total of fifty men has had the unique experience, since last May, of hiring over three hundred hands and I have been told that the men who do the hiring have been so calloused to the conditions that every new hand hired is now known as a "visitor" and bets are often made as to the number of hours (not days) each one will work before quitting.

No, Mr. Editor, this is not the time to write of how to reduce foundry costs, but it is a good time to "mark time" in the hope that some day the slaughter that is taking place on the other side of the ocean will cease and times will become normal once more. Woe unto any concern that does not manufacture war munitions and hopes to hold its own with those that do. Also for the manufacturer who is completely surrounded by munition plants and scorns to participate in the making of instruments of death.

Labor has gone crazy and the pity of it is that while there is no good argument to advance against men earning all they can while the going is good, yet the jobs they hold are made so easy that they are spoiled for the future, when work will be both scarce and hard. The day of reckoning will come and its not very far away and when it does come there is going to be a very wide awakening and the "easy money" will be very scarce. As an example of what to expect from foundry helpers, I will cite an instance that came under my own observation. He was a big strapping fellow and looked as if he was able to lift a ton, but he disappeared one day and by accident I met him on the street a week or so later. I asked him what made him quit his job and he said, "Why that work was terrible hard and my undershirt was almost wet at 10 o'clock in the morning," and as the time of the year was last July I almost believed him.

The scores of "rumhounds" that prey upon unsuspecting brass foundrymen are every day with us and due to the "easy money" they have earned (?) at the munition plants of late they have to become pretty well pickled in whiskey before they will even consider a foundry job nowdays. At pouring time especially it is interesting to note the torture they endure when the heat from the ladles sweat "John Barleycorn's" tears out of their carcasses. Usually one or two heats is enough to send them on their way to the next victim.

If there is any way to shoot up foundry costs higher that beats having a procession of men going in one door of the foundry and leaving the other, I would like to have somebody tell me. Really, Mr. Editor, it would be no stunt at all to write an article on "How to Increase Foundry Costs" just at present as all you would have to do would be to count the men that quit the foundry—though you would have to be some counter, I admit—and multiply the number by the hours they have worked and credit it to absolute loss as most helpers do not remain long enough to be broken in properly; hence their labor is of little value.

Again a fair proportion of foundry laborers have what is known as a "taking way" about them and to find sprue heads, gates and even castings on their person is not an uncommon occurrence and you must admit that as a method of reducing foundry costs it has little to commend it. The usual procedure in cases of this kind is to separate the metal from the man without the aid of a magnetic metal separator, escort him to the exit and wish him a long and tearful adieu and then go back to the clothes drying room and "frisk" the clothes of the next "taker." You should do this after the noon "recess" as it has been found that they are most active during that period and have "stocked up" so as to be ready for the "junkdealers' rush" at quitting time. I know of a number of foundry foremen who have become experts at detecting these cases, but I will not mention their names for fear of detective agencies grabbing them from their present berths.

BRONZE FINISH PARTS.

THE METAL INDUSTRY for December, 1916, contains an article by R. S. B. Wallace on "The Manufacture of Thin-Walled Castings." A formula is given in the article for bronze finish parts. Owing to an error the lead and zinc are transposed. The correct formula is as follows:

Copper	86.00	per cent.
Tin	1.50	" "
Lead	1.50	" "
Zinc	11.00	" "
	100.00	" "

SOME RAPID NICKEL ADVENTURES

A Comparison of Results Obtained With Specially Prepared and Home-Made Plating Salts.

Written for The Metal Industry by Thomas Brown, Assistant Superintendent Tuttle and Bailey Company, Brooklyn, N. Y.

A vast amount of literature has been produced on the subject of nickel plating and plating in general. So it is not with any presumption of finality that this contribution is made, and added to that immense store of information recorded and stored up for the edification of all. Rather, does this article concern one little phase or development of a large industry; or as one might express it, but a small corner of an immense structure, erected toilfully and slowly by painstaking effort and the thought and labor of many tireless workers.

To begin then, nickel plating in its simplest form is a simple proposition. Just a quantity of solution of a certain salt of the metal, a suitable container, a piece of metallic nickel, wires and a source of electrical energy; and the outfit is ready for the deposition of metallic nickel from the solution—and that is nickel plating. And this is true of most any, or in fact, all of the metals which are capable of being deposited in their metallic state from their solution. However, in practice on a commercial scale, it is not quite so simple an undertaking—from a commercial standpoint. For to be commercially successful means that it must be profitable. This naturally, presupposes that it be conducted along the most advanced and approved lines. This means efficiency. We all know that costs *can* be too high. And that anything tending to produce more and better results for the same or less outlay is a distinct gain and of course, very desirable from all viewpoints.

In order to accomplish this desideratum much effort and a great deal of experimentation has been carried on with the result that all plating is quite technical and not nearly so simple a proposition in general practice as in the laboratory. Other materials have been found desirable and even necessary for the ultimate success of many plating operations. Physical considerations have received a great deal of attention and deservedly so. But the main advances may be said to have occurred in the chemical formulas used in preparing the solutions.

In the past, many undesirable additions were made to the solution, materials having no real uses were employed on the assumption that they added something to the value of the solution as a profit-maker. Many of these were actually detrimental, but they were all aimed at the improvement of the simple form of electrolyte. Along with these came fads as was inevitable. These came amid great acclaim and died their natural deaths after varying existences. They belong in the class of "patent-medicine plating nostrums" as Charles H. Proctor has so aptly termed them. So from the mass of information acquired by the slow process of selection and natural elimination, we have today a certain definite fund of reliable data from which to work and draw further inspiration for future successes.

Nickel plating alone, represents a field largely improved and better understood in general, than it was a few years back. Today one knows why each and every element is added to the solution and the part played in the result obtained. Current-density is a thing far better understood and appreciated than in former years. Current conditions are no longer so mysterious as they once were. It is now possible to deposit metal in a bright and lustrous form, and to eliminate in large measure a considerable amount of labor in buffing. The time of deposit is shortened by knowing that a certain form of solution will transmit a certain quantity of current in a given time. All these are gains in the art of plating and represent but some of the advances made in this important field.

Therefore anything tending to add anything of value to what is already known of this subject, ought to be welcome. Conducting salts are the usual means of obtaining high current density and shorter time of deposit and incidentally, they add something to the brightness of the resultant plate, provided that other conditions are right and manipulation of the solution has been carried out properly.

It is not my purpose to go into the merits or demerits of conducting salts generally or to treat of this subject any more thoroughly than the few general references here made. Some interesting results obtained and some little information gleaned is here set forth so that "all who run may read" and with the hope that something worth while and of a little value has been recorded.

The results of some investigations of a "rapid" nickel salt sold at a fancy price may be of general interest. The preparation in question was designed to carry a large amount of current and thus deposit faster than the ordinary double nickel salt solution. In addition it was heralded as a "bright" plating salt, the idea being that it would work a stupendous economy in eliminating to a very large extent the necessity and occasion for any subsequent buffing of the articles being plated after the plating process had been carried out. The finished goods were then to be as bright and beautiful, or nearly so, after plating as before their treatment. And so it proved in general practice. The deposit was exceedingly soft and snowy white and if the pieces were highly buffed previous to their immersion in the bath, and the current was properly regulated and proportioned, they did present a beautiful appearance and required little, if any, subsequent treatment on the buff. However, the material had its drawbacks. If extreme care was not exercised in the preliminary treatment of the work before plating, they were very apt to come out of the bath streaked and stained and discolored in places, to such an extent in some cases, as to require refinishing. But, I am not prepared to say that these occurrences were inevitable, or a fatal defect inherent in the material. To my mind, materials of this sort from which generally satisfactory results are obtainable, represent a long step forward from not only a scientific point of view, but from the standpoint of practicability as well.

The solution studied when finally prepared was an alkaline solution of a density of about 8° B. This will vary slightly with temperature, materials and carelessness in weighing, particularly.

The material investigated upon examination was found to consist of the following:

Water (H_2O)	27.50%
Nickel (Metallic)	14.40%
Sulphates	43.40%
Ammonia (as NH_4)	3.96%

This salt was not of the standard type of double sulphate of nickel and ammonia which has the formula of $(NH_4)_2SO_4$, $NiSO_4$, $6\,H_2O$. The salt under examination proved to contain other salts or a modification of the standard formula. The salt found therein proved to be potassium, an alkali. The most likely explanation for the presence of this element was on the hypothesis that it

was there as an added salt, as potassium sulphate or potassium acid sulphate, but upon reflection it was thought that it may have originated by the use of proportional amounts of potassium and ammonium, so as to cause the potassium to replace one of the NH_4 groups shown in the standard formula, which is quite possible and which would be identified by the formula $K\,NH_4SO_4$, $NiSO_4$, $6\,H_2O$. The sample examined proved to be a very nearly pure salt of this type, no other element other than the potassium being actually found. A slight impurity of chlorides was present, however.

Proceeding along the lines indicated by the results obtained in the analysis, it was then an easy matter to prepare a solution as indicated, producing in the process of such preparation a salt closely following the formula of the salt examined. Practically prepared the proportions were:

1 gallon water
1 pound double nickel salts
1/5 ounce potassium sulphate

Sufficient ammonia was added to give a very slight reaction (blue color) with pink litmus paper.

The purchased material was required to be dissolved in hot water in order to save time, stirring and heating until boiling commenced; just before boiling a small quantity of ammonia was added and boiling continued for 5 or 10 minutes. During the boiling a grayish black scum made its appearance, which had to be skimmed off. The importance of this was emphasized. The proportions of salts to water, as advised, produced a highly concentrated solution which was saturated, crystals forming upon cooling. However, such high concentration was evidently advised in order to save time. The solution, as made, then required filtering while hot and when finally filtered it could then be reduced with water to a density of about 12°B. for ordinary still plating. This was an advantage of no mean order, as it is difficult, if not quite impossible, to approximate a greater density than 8°B. with ordinary double nickel salts.

In preparing the "home-made" salt the same procedure was followed. A quantity of double nickel salts was weighed and the proper proportion of potassium sulphate. This was approximately as given, 1 pound of nickel salts and 1/5 ounce of potassium sulphate. These proportions follow the formula as given, for practical purposes, and are based upon the molecular proportions by weight, of the salt copied. The nickel salt was first powdered and the proper quantity of the powdered salt was used and then the sulphate of potassium was added and then mixed thoroughly. The result was a product exactly resembling the article under investigation. This, however, is no test, but the rest of the program was carried out religiously and the same practical results were obtained as with the purchased material.

By the same method of figuring, an ordinary solution of double nickel salts was treated and the same general result was again obtained. This solution originally stood at 6°B., the specific gravity being approximately 1.041 By addition of the molecular weights, proceeding on the theory of a simple solution of nickel ammonium sulphate having the standard formula, the approximate quantity of salts per gallon was estimated. The same treatment of boiling, etc., was followed and the result was always the same. Then an interesting thing was discovered! Following the same general plan, another solution was employed and its general proportions estimated and the proper quantity of conducting salt (potassium sulphate) added after being dissolved in the minimum quantity of hot water necessary, as this salt is not very soluble; and no further treatment was given it. That is to say, the usual boiling was dispensed with and the solution was then put to work. The result in all cases was uniformly the same. The deposit was soft, lustrous and very bright, little or no buffing being necessary on highly finished pieces. It was noticed that when a piece of work was over-plated the deposit became cloudy, and finally a silvery, dead white; exceedingly beautiful and soft, except where it was excessively "burned." In all cases, the required amount of ammonia was added, of course, to bring about the alkaline reaction; and in all cases the solutions were operated as alkaline baths. From time to time a small quantity of ammonia is needed to keep the solution alkaline, as it has a tendency to become acid, owing to the free sulphuric acid formed in the solution, by the action of the electric current, combining with the ammonia and thus gaining the ascendancy. However, a little free sulphuric acid is necessary in order to dissolve the anodes, and it is only when the solution, after standing for a period, as overnight, gives an acid reaction with blue litmus, that it is necessary to add more ammonia. As may be surmised, a nice "balance" must be maintained in this respect in the manipulation of this type of electrolyte, and it may be said in all truthfulness that such a bath requires considerably more attention than the commoner kind.

And right here is where individual considerations enter largely into the question of the desirability of a bath of this composition. Questions of policy as regards many factors, such as the character of the product to be plated, selling-price, use, etc., must be carefully taken into account. As usual, what is profitable from many viewpoints in one shop may be the exact opposite in another shop, with different problems to consider.

The results sketched in, in this article are recorded merely from the point of interest, and in the belief that they may be of some value to the plating fraternity, rather than as any particular dogma to be followed. There is no criticism levelled at any particular method, or material, and that is why there are no products named or no comments made other than those necessary for the proper elucidation of the subject referred to. The simple results of a very practical, not a strictly scientific, investigation, have been recorded and what little knowledge thus gleaned is set forth for what it may be worth to the plater or the plant making use of it. As a matter of manly justice, I do not hesitate to say that the formula worked out, and the material used, give excellent results and undoubtedly have a definite and secure place in the modern practice of electro-plating. This much I will say, however, candidly and in good humor. The prepared salts at about five times the price of ordinary double nickel salts do not pay; when by individual preparation in the shop the same general results can be obtained at an outlay of a trifle more than one cent per pound over the cost of ordinary double nickel salts. At least this was the proportion of cost some time ago when the investigation set forth in this article was made. Since that time prices of all chemicals have risen abnormally, so it is doubtful if the same cost proportions hold good. But at the figures indicated the purchased salts were distinctly a "poor buy" when contrasted with the home-made article.

A SUBSTITUTE FOR TINFOIL.

Consul Harry G. Seltzer, at Breslau, Germany, reports that one of the Breslau tinfoil factories has succeeded in providing a substitute for tinfoil by producing zincfoil. The new product is not to be distinguished from tinfoil and is supposed to render the same services.

HOW TO OBTAIN THE ACCURATE COST IN MANUFACTURING BRASS GOODS

A Practical Method for Distributing Expense in an Industrial Plant.

Written for The Metal Industry by P. W. Blair, Superintendent Brass Finishing Department H. Mueller Manufacturing Company, Sarnia, Ontario, Canada.

The problem of obtaining the actual cost of production in the manufacture of brass goods has been given great consideration within the past few years by the manufacturers and has been the means of reducing the number of concerns from going into the hands of receivers. It is the great desire of the manufacturer to reach an accurate cost of production for by this, and this only, are they able to figure out whether they are actually making a profit each month.

P. W. BLAIR

The cost of a manufactured article consists of three parts or items which are burden expense, raw material and time of labor. The burden or overhead expense is arrived at by adding together all the items of fixed charges, office expense, selling expense, material consumed in manufacturing, such as oil, cotton waste, etc., which cannot be charged directly to any specific article, non-productive labor, which should be obtained by dividing the pay roll into two parts; productive and non-productive. The total of this non-productive pay roll should go into the burden. This burden or item of expense amounts to a large sum and not one cent of it has been paid for actual production and the question arises how to get it back. It cannot be added to the cost of raw material and be accounted for in this way for the raw material has not caused any of this expense. Nor can it be charged to non-productive labor for that has not produced anything that can be sold and thus get the money back. There is then nothing left to charge or add this burden of expense to but productive labor.

Not until the work has been started on raw material is there anything produced by or from which the money paid out for burden expense can be gotten back. Therefore, we must add the burden expense to productive labor. The question now arises how can it be added and still have it properly distributed. It will be said that it should form a certain per cent. of the cost of material and labor, but as I have said the raw material has had nothing to do with expense, therefore a certain per cent. should not be added to the cost of that material as a burden. It is the productive labor that consumed that burden. Still it will also be said that a larger per cent. should be added to the cost of labor, but this will not do either. For example, there are two men working at molding, and one is paid the maximum rate of 45 cents per hour and the other the minimum of 20 cents per hour. Each man works on his respective class of work for 18 hours, and by the percentage method 40 per cent. of labor cost is charged on each man's work to cover the burden expense. On this basis, for the first man's share $3.24 is charged and only $1.44 for the second man; though it cannot be understood where the first man consumed more of the actual burden expense than the other, yet twice as much is charged to the first man's labor.

In order to get the proper amount to add to this labor to cover the expense, the total amount of the burden expense should be divided by the total number of productive hours. For instance, the burden expense is $720 and the productive hours are 3,600, this gives a burden rate of 20 cents for each productive hour, therefore to the first man's wages add the burden rate of 20 cents per productive hour for 18 hours $3.60, thus making labor $8.10, burden cost $3.60 and material $4.50 with a total of $16.20 for the absolute accurate cost. To the second man's wages of $3.60 add the burden hour rate of 20 cents for 18 hours, thus making labor $3.60, burden cost $3.60 and material $1.50, the accurate cost being $8.70. Then to this add what per cent. of profit is intended to be made.

By the percentage method or basis add 40 per cent., or $3.24 to the first man's wages of $8.10, material $4.50, making a cost of $15.84 a difference of 36 cents short of actual cost. To the second man's wages of $3.60 add 40 per cent., or $1.44 plus cost of material, which is $1.50, making a total of $6.54, a difference of $2.24 short of actual cost. This is where the profit that has been figured on will be reduced. If this will be given careful consideration, it will be seen that it is the only way to arrive at the accurate cost.

Now take another example, if there are three men working by the piece on polishing or buffing, and the first man is paid 40 cents per hundred, in six hours he turns out 475 pieces or he receives $1.90. The second man is paid 50 cents per 1,000, and in six hours he turns out 6,000 pieces or $3.00. The third man is paid 1 cent apiece and in six hours he turns out 225 pieces of $2.25. If 40 per cent. is added to labor cost, 76 cents will be added to the first man, $1.20 to the second and 90 cents to the third, whereas each of them has taken six hours and consumed an equal amount of the burden expense and should be charged an equal amount. Therefore, on a percentage basis, each man would be charged a different amount for burden expense.

It is necessary to keep a record of the number of hours that piece hands work in order to obtain the accurate burden their product should bear.

Another example is a girl coremaker starting to work in the morning and works only half a day or five hours and earns $1.00. By charging 40 per cent. to this to cover burden expense, the amout is $1.40. This burden expense keeps right on the other half of the day, but what bears it? If she had worked the other half day, she would have earned $2.00, and 40 per cent. burden expense makes $2.80. Although the burden expense went on just the same, yet the girl did not work, and according to regular methods it cannot be charged to her labor. Where does it come in? If an hour rate had been obtained by dividing the total burden expense by the total productive hours, the burden expense for this half day she did not work would be properly and accurately taken care of.

It is comparatively easy to obtain the cost of material that enters inot the manufacture of brass goods, but the time or labor is the chief element of cost; also the proper burden rate has been difficult to ascertain. The large

number of concerns in the manufacture of brass goods within the past few years that have gone into the hands of receivers can be ascribed to the fact that they did not know the cost of the goods they were manufacturing and were going on the supposition that if another manufacturer could sell the same class of goods at that price, then they could go them a cent or two lower and compete with them for the business. The most successful manufacturers in the brass business today are the ones that have been established for years and know the cost of the goods they manufacture and sell them at a reasonable profit.

THE ALUMINUM INDUSTRY IN 1916

A Brief Review of Price Conditions for the Past Year.

By Aluminum Man.

The state of the aluminum business during the year 1916 has been a continuation of the state of affairs existing in the latter part of the year 1915. The demand for aluminum has, in common with the demand for all of the common metals, continued throughout the year at a level so high as to severely tax the producing capacity, notwithstanding substantial additions made to the production.

There have been almost no importations and a strong export demand has prevailed throughout the entire year.

Practically all of the domestic consumption has been taken care of at prices ranging from 31 cents at the beginning of the year to 37 cents at the end of it. The principal domestic producer sold its entire output early in the year at these prices, thus providing metal for the great bulk of the domestic consumption. As the entire output of the principal domestic producer was thus disposed of at these prices, no metal was left to take care of small lots for spot delivery, with the result that domestic spot prices through the greater portion of the year were controlled by the prevailing prices abroad. The European demand throughout the year continually exceeded the European supply and the ruling European prices have ranged from 55 cents to 65 cents per pound. Inasmuch as these prices were offered here throughout the year for aluminum for export, they controlled the prices for spot deliveries here and as the only metal available for these small lots required from time to time was that which could be bought from those who had supplied themselves at the 31 to 37-cent rates and were willing to re-sell, or that which could be obtained from scrap dealers, these spot prices, which are those which have appeared in the quotations in the metal trade journals, have been substantially the prices prevailing in the European market, that is, from 55 cents to 65 cents per pound.

The reason that the bulk of the domestic demand was provided for at the prices of from 31 cents to 37 cents per pound in spite of the continued demand for the metal for export at higher prices was due to a continuation by the principal producer in this country of its policy of supplying the bona fide consumption at the lowest rate the market conditions permitted, the policy including the reservation of its entire United States production for United States consumption.

Substantial additions to the production have been brought into operation during the year; in northern New York State by additional water power purchased and brought to the existing works; in Tennessee by additional power purchased and brought to the existing works in North Carolina by power brought to the site of the large development at Badin. The large development at Badin, which is to be operated by power obtained at that point from the Yadkin River, is nearing completion. The progress on this plant, which was hoped to have been brought into operation during the year 1916, was delayed by the unprecedented floods general in the South Atlantic States during the early summer. This flood included the Yadkin River watershed and swept away a portion of the work and of the construction equipment. It is now expected that this large development, which will materially increase the available supply of aluminum, will come into operation early in 1917. During the year work was begun on the large power plant on the Little Tennessee River, which power plant will be completed during the year 1917 and will go into operation late in the year. The power from this plant will be carried by transmission line to the site of the existing works at Maryville, where additional aluminum producing capacity is being installed to make use of it.

In fact, it appears probable that the producers of aluminum, in common with the producers of all the other common metals, have increased their plants so extensively to take care of the present abnormal conditions that they are likely to have a large excess in capacity and much idle equipment on their hands when the metal demand returns to a normal condition.

The production during 1916 was interfered with to some extent by labor troubles, and the completion of additional capacity has been seriously hampered by slow delivery of materials and delays in transportation. Notwithstanding all this, however, the production has been almost as great as was expected and substantial additions to the producing capacity, which will come into operation during 1917 and 1918, will supply all the legitimate domestic demand for the metal.

The general conditions, however, indicate that the consumer who does not exercise foresight and anticipate his requirements will be likely to be penalized by having to pay high prices for immediate delivery.

During the year 1916 a large addition to the existing fabricating capacity for aluminum was made by the completion and bringing into operation of the large metal working plant at Edgewater, New Jersey, containing as a portion of it the most modern rolling mill plant in existence for rolling aluminum. This plant is now taking care of a large proportion of the demand for fabricated aluminum from the Eastern and Middle States.

RECOVERING WASTE METAL.

In order to make waste metals fit for smelting, it is necessary to disintegrate them and separate any coating, such as enamel, with which they may be covered. Usually this has been done by passing the waste through rolls in such a manner as to bend it, and also to pass it through inter-meshing discs which cut the metal into strips.

A German named A. de Back, assigned to an American company a patent for removing the enamel and disintegrating the metal, both operations being performed by one machine, which tears the metal to pieces. There are two inter-meshing trains of rolls with fluted surfaces, one train above the other. Part of the rolls is extended lengthwise, and another part has flutings at right angles. Hence the ready disintegration. In passing between the trains the metal is crumpled and torn in every direction, and the enamel removed at the same time.

SOLVING THE CYANIDE SHORTAGE

SOME VALUABLE SUGGESTIONS OF INTEREST TO THE CYANIDE USERS.

WRITTEN FOR THE METAL INDUSTRY BY C. B. WILLMORE, ELECTRO-CHEMIST.

The question of supplies, particularly cyanide, for the plating room is steadily becoming most serious. The prices of cyanides and other essential supplies are advancing at a rate that is without precedent; they have already reached an elevation that is well-nigh prohibitive and are still soaring towards a point which seems to be located on the other side of infinity. To the manufacturer who must meet the prices, the situation has become a nightmare of daylight robbery, if I may be permitted such a mixed figure of speech. To the plater it is a wearying round of trying to get along without this and that chemical, and a promise of a shut-down in the near future from the inability to get those necessities at any price.

Of course the war is blamed for it all. But most of these products are made in this country, and the raw materials are still available at prices which, while they are considerably above normal, are nevertheless not at all in proportion to the prices asked for the finished products. The explanation is more properly to be sought in the surmise that a single company has control of their manufacture and is holding out for unfairly large profits. In support of my statement I shall give later on brief outlines of the processes by which these products are manufactured, and the raw materials from which they are derived.

At present writing, December 12, 1916, cyanide is temporarily priced at $1.45, taken on the run as it soars past. Ammonium sulphocyanate, essential to the black nickel process, is difficult to get at a price of $2.50 per pound for small lots. At such prices, which no doubt will be even farther advanced when this is published, it is evident that any methods for effecting savings in such materials cannot be safely ignored, and that any simple methods, however crude, by which the plater may prepare sufficient material for his own needs from comparatively cheap components are well worth a trial.

There are a number of ways in which savings in cyanides over the usual methods may be effected; and, furthermore, there are simple emergency processes by which a fair grade of cyanide, suitable at least for cleaning purposes, and, in fact, approaching the quality of certain cyanides now on the market, may be prepared. Sulphocyanate of sodium and ammonium are not required in large quantities; but the need for the small quantities used is very urgent, and it will no doubt interest many platers to learn that both of these materials may be easily prepared on a small scale in the factory.

COMMERCIAL METHODS OF PREPARING CYANIDE.

The source of most of the cyanide manufactured is sodium ferrocyanide $Na_4Fe(CN)_6.12\ H_2O$, also known as yellow prussiate of soda. This in turn has two main sources. The old method of forming it is by calcining a mixture of iron filings or borings, soda ash, and nitrogenous organic material, such as hair, dried blood, woolen rags, etc., first fusing the iron and alkali together in an iron pot, and then adding the organic matter in small quantities. The charge is then heated higher with the furnace closed from the air. After cooling, the yellow prussiate of soda is leached out of the mass and then crystallized.

Illuminating gas, as manufactured, contains cyanogen, which is removed by passing the gas through an alkaline solution of ferrous sulphate, whereupon it is precipitated as ferric ferrocyanide or prussian blue. The yellow prussiate is also prepared from this.

The method most used at present for forming cyanide from the prussiate is to fuse the prussiate with metallic sodium, the products being sodium cyanide and metallic iron which settles out. The action is as follows:

(1) $Na_4Fe(CN)_6 + 2\ Na = 6\ NaCN + Fe.$

An older method is to fuse the prussiate with soda ash. Here, however, sodium cyanate NaCNO is formed along with the cyanide as follows:

(2) $Na_4Fe(CN)_6 + Na_2CO_3 = 5\ NaCN + NaCNO + Fe + CO_2.$

Other methods which have been proposed and used to a greater or less extent consist of passing nitrogen or ammonia gas over mixtures of red hot coke and soda ash or metallic sodium. Also calcining alkaline tartrates or acetates with nitrate or nitrite of soda.

Cyanides are also produced commercially by the electric furnace process for the cyanide ore-extraction industry. The process consists of first forming calcium carbide, CaC_2, in the electric furnace and then passing pure nitrogen over this at a red heat to form calcium cyanimide, $CaCN_2$. This is then fused with a further quantity of carbon and a little common salt, whereupon the calcium cyanimide is converted into calcium cyanide:

(3) $CaCN_2 + C = Ca(CN)_2.$

The material as prepared is equivalent to about 30% KCN and is used for ore extraction.

A better method consists of leaching the cyanimide with water to extract soluble dicyan-diamide, $(CN.NH_2)_2$, as follows:

(4) $2\ CaCN_2 + 4\ H_2O = (CN.NH_2)_2 + 2\ Ca(OH)_2.$

The dicyan-diamide is easily purified by crystallizing and is then fused with sodium carbonate and a little carbon to form a good quality of cyanide:

(5) $(CN.NH_2)_2 + Na_2CO_3 + 2C = 2\ NaCN + NH_3 + H + 3\ CO. + N.$

HOW CYANIDE MAY BE MADE BY THE PLATER.

At present, yellow prussiate of soda is selling at from ¼ to ⅓ the price of sodium cyanide, and it is reported that there is a reasonable supply available on the market. It contains about 30% cyanogen, as against 53% cyanogen in perfectly pure sodium cyanide, so that when the price of prussiate is about ⅓ that of cyanide, or less, the cyanogen in the form of prussiate is cheaper than in the form of cyanide. If the factory has the facilities for fusing about fifty to one hundred pounds of material at a time in a good sized iron kettle, it would pay the plater to have his sodium cyanide manufactured in the factory. The only apparatus required is an iron kettle of about two cubic feet capacity, a large forge or furnace and a hood and fan for carrying off the fumes, as sodium cyanide is somewhat volatile at fusion, and the fumes are poisonous.

According to chemical equation (2), for manufacturing 100 pounds of sodium cyanide there will be required a little over 200 pounds of yellow prussiate, and about 45 pounds of soda ash. The materials should be as well dried as possible, and should be well mixed before fusion. Heating should proceed somewhat cautiously while the materials are reacting and the carbon dioxide is coming off. It will require a good red heat to fuse the material, and it should be kept covered in order to prevent oxidation. It should be allowed to stand quietly for a short time after fusion in order to permit the iron to settle out, after which the molten cyanide may be poured into iron molds.

According to the equation, along with the 100 pounds of sodium cyanide there will be formed about 15 pounds of sodium cyanate, NaCNO. This, however, is harmless, and may be largely converted over to sodium cyanide by mixing about 5 pounds of ground anthracite coal with the original charge, and placing a layer of the coal on top of the charge.

By simple fusion of the yellow prussiate alone, pure cyanide may be formed plus iron carbide; but some of the nitrogen is lost.

Calcium cyanimide is sold on the market as a fertilizer, the cost being governed by its nitrogen content. On the basis on which it is sold, pure $CaCN_2$ would cost about 6 or 7 cents per pound. It must be, and usually is, free from calcium carbide, an impurity which would interfere with the reaction. By fusing the cyanimide at high temperatures with carbon in the proportion of about 6 pounds of cyanimide to one pound of powdered coal, calcium cyanide may be formed, according to the equation already given. An additional half pound or so of common salt will reduce the melting point of the charge, but will dilute the finished product.

The product of this fusion, calcium cyanide, is soluble in water and is sold under the name of "cyankalium surrogat" or "cyanide substitute." It should be perfectly satisfactory for such purposes as cleaning off oxides and to prevent metals from staining after acid dipping. At the present list price of cyanimide, it should cost not over ten cents per pound, on the basis of 100% calcium cyanimide, to manufacture. The material as thus manufactured by simple fusion is of course quite dirty from uncombined carbon. Such foreign matter may easily be removed by filtering the solution through several thicknesses of muslin, or through an old felt hat.

To prepare sodium cyanide from cyanimide, pulverize the cyanimide well, if it is not already so, place it in a barrel and digest it with warm water by stirring it around for from a quarter to a half hour. Try to keep the solution as concentrated as possible. To this end it is better to use several small portions of water to extract the material. The water reacts with the cyanimide according to equation (4) to form dicyan-diamide, which then dissolves in the water.

After digesting the material with the warm water, allow it to settle for a few minutes, and then pour or siphon the liquid off the top through a felt or muslin filter. This solution should then be concentrated by evaporating in a large pan or kettle,—a steam-jacketed potash kettle will do very well. After the liquid has been concentrated to the point where small crystals begin to form around the edge, allow it to cool, whereupon the dicyan-diamide will crystallize out in small white needles. The mother liquor may be drained from the crystals, concentrated further, and another crystallization made.

According to equation (5) 100 pounds of the dicyandiamide should then be mixed with 126 pounds of sodium carbonate, and about 15 pounds of powdered coal and fused, heating rather carefully while the gases are coming off. When the fusion is quiet, pour the molten liquid into iron molds to solidify. If care is used in the preparation ,the finished product will be a good grade of sodium cyanide. It may contain some uncombined carbon, but this is easily removed by filtration, at the time the cyanide is used. The theoretical amount of sodium cyanide that can be produced from 100 pounds of cyanimide is 115 pounds.

ECONOMY IN THE USE OF CYANIDES.

There are four important ways in which cyanides may be lost from the solution. Cyanides in solution are slowly decomposed by heat, forming alkaline formates and ammonia. Hence, hot cyanide solutions are much more costly to maintain than cold ones. Under normal conditions, the increased cost of maintenance is outbalanced by the increased rate of deposition which is made possible, resulting in an enlarged capacity and a consequent reduction in overhead charges. But at the present time in most cases it is rather doubtful if the increased cost of maintenance is worth while.

In contact with air, cyanides are slowly converted into carbonates with the loss of cyanogen. This action may be looked upon as an oxidation, as the carbon atom in the cyanogen molecule is oxidized to CO_2 and the nitrogen is given off as such. The product left in solution is sodium carbonate.

In the cyanidation of ores it has been found that the addition of sodium hydroxide to the solution cuts down the rate at which the air decomposes the cyanide. Sodium hydroxide is not ordinarily recommended for cyanide plating solutions; but it appears to be harmless in fairly small quantities, and it is believed that the addition of one or two ounces per gallon will assist in reducing maintenance costs without injuring the deposit.

It is self-evident that a leaky tank is a great source of loss, and should most certainly be remedied immediately upon discovery. Yet the author knows of one case, in a plating room using about 3,500 gallons of copper solution, where it is estimated that upwards of two hundred dollars worth of solution are being wasted per week by leakage. The tanks are still in use in spite of the fact that new ones would pay for themselves inside of two or three weeks, simply because the red tape in use at this particular plant will not permit their installation for some months to come.

In making up copper cyanide from a cupric salt, such as the sulphate or carbonate, there is a loss of cyanogen due to the changing of the copper from the cupric to the cuprous form, as follows:

(6) $CuCO_3 + 2\ NaCN = CuCN + Na_2CO_3 + CN.$

Here is it seen that one half of the cyanogen is lost, and this fact forms the basis of the contention that solutions can be made more cheaply from metal cyanides than from metal carbonates.

The truth of this statement, however, will depend entirely upon the relation between the market prices of the metal cyanides, the metal carbonates, and sodium cyanide; furthermore, where sodium sulphite is used in making up the solution, the cupric salt is converted to the cuprous salt by the reducing influence of the sodium sulphite, and the above mentioned loss of cyanogen does not occur.

To assist in comparing the relative costs of the two methods, the author has prepared a chart showing the cost of making up the equivalent of one pound of copper cyanide from copper carbonate and sodium cyanide. In the chart the vertical lines represent prices of copper carbonate, while the horizontal lines represent prices of sodium cyanide.

The use of the chart may best be explained by an example. Suppose that copper carbonate is selling for 30 cents per lb. and sodium cyanide for 75 cents per lb. To find the resulting cost of one pound of copper cyanide, find the point where the vertical line representing copper carbonate at 30 cents intersects the horizontal line for sodium cyanide at 75 cents. This is shown by a circle on the chart. The nearest diagonal line then gives the cost of making up a pound of copper cyanide, which in this case is between 80 and 85 or about 82½ cents. If at the same time copper cyanide is selling for less than this, then its use is thoroughly justified.

SUBSTITUTES FOR CYANIDE SOLUTIONS.

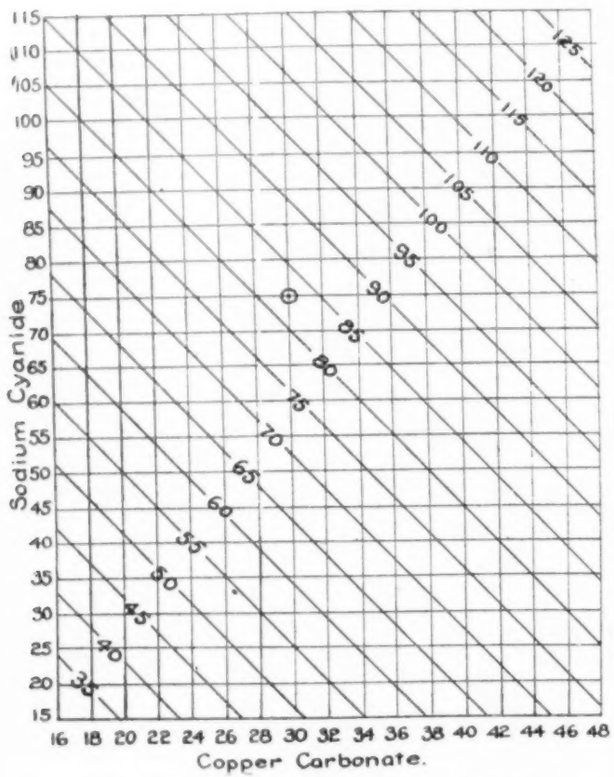
In some places where iron and steel is copper plated, it has been found necessary, owing to the scarcity of

cyanide, to return to the old practice of first giving the articles a light nickel plate, and then transferring them to a copper sulphate bath.

The author has recently developed an alkaline copper solution which does not contain cyanide. The experiments have so far shown that the solution has properties which are very similar to those of the cyanide solution, that it costs, at the present time, about one-fourth as much to prepare, and much less to maintain, and that it is non-poisonous. The solution is about to be tried out on a commercial scale, and it is likely that the author will soon have some interesting results to report.

For brass solutions, cyanide appears to be indispensable, as there is at present no other solution known for the successful deposition of brass.

For silver there is a possibility of using yellow prus-



DIAGONAL LINES SHOW THE COST OF FORMING COPPER CYANIDE.

siate of sodium in place of cyanide, when the yellow prussiate is sufficiently cheaper than cyanide to warrant the change. Langbein recommends such a solution. Also, it is said that sodium silver cyanide may be prepared by heating a solution of yellow prussiate of soda with ammoniacal silver nitrate, the iron in the prussiate being precipitated as ferric hydroxide.

MANUFACTURE OF SULPHOCYANIDES.

There are two simple methods which the plater might use for preparing sulphocyanide of sodium or ammonium. Either the sodium or ammonium salts can be used in the black nickel solution. The first method, which is being used very successfully, is to fuse together sodium cyanide and sulphur. The reaction is as follows:

(7) $NaCN + S = NaCNS$.

The proportions are about two pounds of sodium cyanide and a little over one pound of sulphur. The kettle should be kept covered during fusion to prevent oxidation. The product will be nearly three pounds of sodium sulphocyanide, which can be purified by filtration and re-crystallization.

The ammonium sulphocyanide may be prepared by evaporating aqueous ammonia and an alcoholic solution of carbon bisulphide, as follows:

(8) $2\,NH_4OH + CS_2 = NH_4CNS + H_2S + 2\,H_2O$.

The proportions, by weight, will be one pound of carbon bisulphide to the following parts, by weight, of commercial ammonia.

Eight pounds of 16 degree (Beaume) ammonia,

Five pounds of 20 degree ammonia, or

Three pounds of 26 degree ammonia.

In order to cause the ammonia and carbon bisulphide to mix well, it will be necessary to add about 30% of denatured alcohol. During the evaporation, it may be found necessary to add more alcohol. The product will be practically pure ammonium sulphocyanide, and it can be prepared more cheaply than the sodium sulphocyanide described above.

NICKEL-PLATING ALUMINUM

A method of plating introduced in France appears to be successful. The aluminum is passed through a bath of boiling potash, and then rubbed with milk of lime. After that it is soaked for several minutes in a bath of 2/10 of 1 per cent. of potassium cyanide. Then it undergoes these processes: Subjected to the action of an iron hydrochloric acid bath, consisting of 500 parts of hydrochloric acid, 500 parts water, and 1 part iron, until the metal takes on the appearance best described as a metal "watering." After each of these operations it is washed in water. The nickel-plating proper presents no features of importance, so far as the composition of the electrolyte is concerned. The following formula is satisfactory: Water, 1,000 cub. centimeters; nickel chloride, 50 grammes; boric acid, 20 grammes.

For depositing the metal there is used a tension of 2½ volts and a current density of 1 ampere. The piece of metal coming from the bath has a pleasing soft gray appearance, and easily takes on a metallic luster when polished with a wi[illegible] brush.

Whether the plating be light or heavy, the deposit is remarkably adherent, far superior to that obtained by any other method. This fact led the inventor to term it "aluminum metal," as if it were a true alloy, and not a plated surface.

Aluminum nickel will bear hammering. In sheet form it can be bent without cracking, and it is only by fracture of the aluminum that the under-substance is revealed. Aluminum nickel can be heated without deformation up to the fusing point of aluminum.

It would seem that the peculiar surface which the aluminum bears when it issues from the hydrochloric bath gives the nickel an opportunity of depositing itself under conditions especially favorable for rendering it adherent. The result is not at all the same if hydrochloric acid of equal dilution be employed alone. A close examination shows that on the aluminum sheet from the iron acid bath a light deposit of iron is found. The iron appears to form a network on the surface and develops a multitude of couples, which assist the hydrochloric acid to attack at certain points. The nickel becomes so "rooted" in the aluminum, and forms so perfect a bond that it cannot be removed without taking with it particles of the aluminum.

DESIGN VALUE OF DECORATIVE MOTIFS

A Series of Articles on This Interesting Subject Has Been Prepared by the Author With the Object in View of Giving the Student Craftsman in Art Metal Work a Comprehensive Idea of the Design Value of Decorative Motifs, Their Characteristics Peculiar to the Particular Period or Style in Which They Appear and so far as Possible to Explain Their Origin, Symbolic Significance and Decorative Value. It Is the Author's Sincere Hope That the Series Will Fulfill the Purpose for Which It Has Been Prepared.

Written for The Metal Industry by A. F. Saunders, Designer Benedict Manufacturing Company, East Syracuse, N. Y.

ARTICLE ONE. PRIMITIVE DESIGN.

The desire to embellish, to ornament, is instinctive in the human race. We find evidence of this natural desire as far back as we have been able to trace mankind.

PLATE I.

1. LAGUNA POT, BIRD MOTIF, NEW MEXICO.
2. LAGUNA BOWL, FLORAL MOTIF, NEW MEXICO.
3. ZUNI BOWL GEOMETRIC ORNAMENT, ARIZONA.
4. PAPUAN BOWL, CARVED COCOANUT SHELL, BRITISH NEW GUINEA.
5. CARVED PADDLE, MAORI TRIBE, NEW ZEALAND.

The first definite forms of decoration were cut or scratched on the rude implements and utensils used by the savage of prehistoric times. However crude and meaningless most of these efforts may appear to the more cultured and trained mind and eye of the present age, to primitive man each motif selected or designed to embellish an object had some meaning, some symbolic significance to him or his tribe.

Naturally, his first ideas or inspirations were received from what his surroundings suggested. Nature, in her multiplex forms, offered a veritable storehouse full of ideas and motifs of decorative use. Everything that he observed suggested design, if his mind and eye but perceived it. In the early stages of primitive ornament geometric motifs formed the basis of decorative design, not because the primitive mind had any natural bent toward geometry, but because in the practice of the earliest crafts the materials used necessitated an expression through geometric design. In weaving or plaiting strands of grass or rushes into articles of daily use, various patterns were suggested and seized upon as a keynote of decorative design. Later on, when clay, wood, bone and metals became generally employed, graphic expression was attempted. Plant, animal and bird life formed a source of inspiration, resulting in a translation of animate life into terms of geometric design. Each tribe, race, or nation, in fact, each individual depicted or expressed in his own way the particular subject, motif or pattern selected to ornament. Environment, temperament, racial habits, all had their influence upon the mind of the individual, the tribe and the nation. This in turn influenced the efforts made in decorative art. While we of course cannot mention style in connection with the crude and disconnected efforts at decorative design of primitive peoples, it nevertheless formed the foundation upon which definite styles were constructed later on. The more closely we study the development of decorative design the better we understand this gradual transition from the crude efforts of early man to the decorative art of our own time.

The systematic arrangement of plant and animal forms as motifs of ornamentation, in addition to geometrical elements, has offered us the material upon which many of the facts of history are based. The oldest decorative motif of which we know is the so-called "Swastika" or "Svastika," of unknown origin, in immemorial use throughout every race and country of the world. Its use and symbolic meaning has been maintained in uninterrupted sequence through countless generations down to modern times. Its mystic charm and decorative value seem as great to-day as they were a thousand years ago. No single decorative motif has aided the purpose of ornamental design more than this simple device. We find it forming the keynote to a decorative scheme of wall decoration in some of the temples of ancient Egypt. It becomes the motif for the origination of the Greek fret or key pattern. It can be traced out in the interlacings of Celtic and Scandinavian ornament; its form varies

but little with the various peoples. It is found in India, China, Siberia, on the pottery of ancient Cyprus and Etruria, among the ruins of the Aztecs in Peru. The Indians of our own Southwest beat this design out of silver, carved and painted it on their pottery and looked upon it as the sacred symbol of "good luck." Its symbolic significance has been practically the same the world over, that of a magical sign insuring long life and good fortune as a Divine benediction. As a decorative motif the "Swastika" in its varied forms offers the basis for an unlimited range of design possibilities to the metal worker. It is most decorative as a motif and its supposed mythical charm adds an unusual touch of interest to its use. Illustration No. 1 shows several of the varied forms of the "Swastika," also its application and use as a decorative unit.

Illustration No. 2. Primitive decoration, showing various forms of plant and bird life, also geometric motifs and scroll forms.

The next article of the series will describe the decorative value of the bird, several plant forms, and symbolic motifs.

(To be continued)

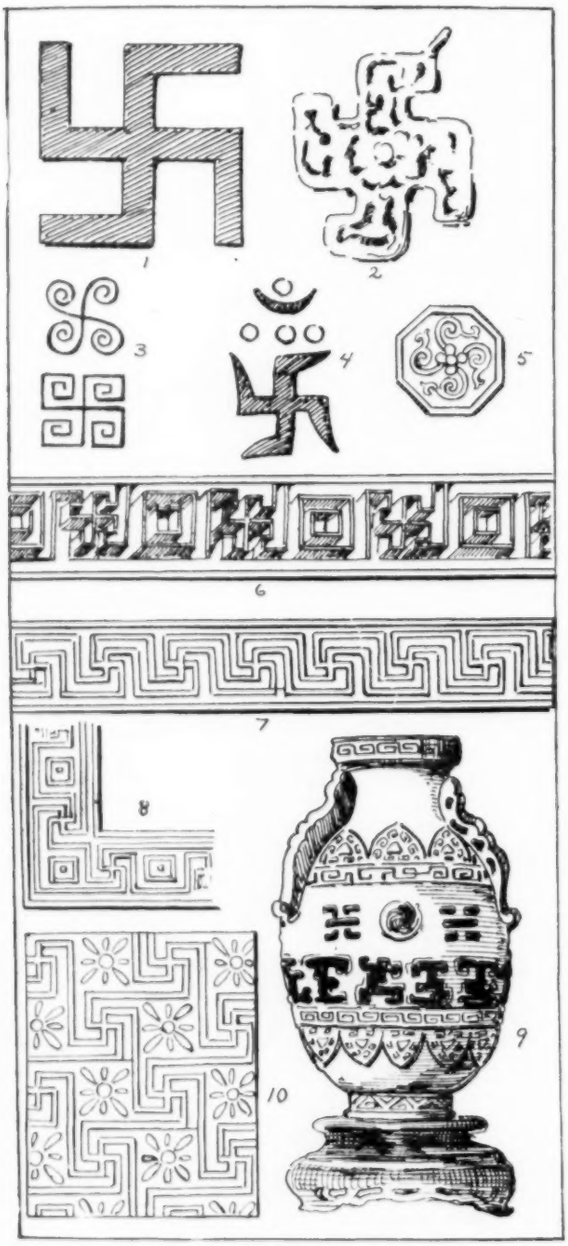


PLATE II.

SWASTIKA

1—COMMON OR NORMAL FORM OF SWASTIKA.
2—METAL CHARM OR PENDANT, SIBERIA.
3—TRISKELIAN FORMS.
4—BRAHMAN JAINOS SWASTIKA.
5—CHINESE LUCKY PIECE.
6-7-8—SWASTIKA MOTIF IN GREEK FRET-WORK.
9—CHINESE BRONZE VASE, FROM YUNG-TCHING EPOCH.
10—SWASTIKA MOTIF USED IN EGYPTIAN WALL DECORATION.

WESTERN VS. EASTERN COST PRACTICE

"We have been confronted with a matter of costs between our machine shop and foundry and we would like to ascertain the general practice of cost systems in the large eastern foundries as the point in question, i. e., the foundry sends to the machine shop castings to be finished, say 100 valve stems. These castings were machined and apparently were good enough to send to our customer. When the customer received same he found a portion of them defective. Upon their return we found that the metal was defective in the castings. We replaced these castings to our finishing shop free of charge and the machine shop did the finishing on the replaced castings as well as on the defective ones that have gone out, standing all the finishing expense. Would you consider this practice a wrong one and should the foundry stand for the machine operation on the defective castings?"

The foundry should be charged up with the entire expense for the replacement of these goods as it was the cause of the goods being defective. If the defective parts had been discovered in the process of machining the foundry would have been charged up with the castings then.

Should the customer have discovered defective threads or that the diameter was not correct according to the sample or drawing submitted and returned the articles on that account then the finishing department should be charged up with the entire cost. Of course, the company has to bear the entire expense and it only goes on record to show what it is costing to operate the different departments per month. That is, where a large number of brass manufacturers do not know what their different departments are costing to operate them, as in a case like this, the entire cost is charged up to no single department, that is the cause of the loss, but is spread over all the departments.

There are some manufacturers of brass goods who have so much confidence in the quality of the goods they furnish their customers that they back up their guarantee with the fact that they will replace any defective goods with two in place of one for every one found defective.—P. W. B.

CONDEMNATION OF PLATINUM VESSELS

The high price of platinum apparently has its sequel. A well-known professor stated recently that no American-made platinum productions were any good. Some other users are reported as saying that "platinum" vessels of American origin contain so much iron and iridium that they cannot be used for accurate analytical work. This is a serious arraignment of costly articles, and it does not appear to be disposed of by anything put forward on the manufacturer's side.

SHALL WE HAVE COMMERCIAL STANDARDS OF ELECTRO-DEPOSITS AND GOVERNMENT MARKS OF KARAT ALLOYS?

SOME REASONS WHY THEY WOULD BE DESIRABLE AND SOME SUGGESTIONS AS TO HOW THEY COULD BE ESTABLISHED. WRITTEN FOR THE METAL INDUSTRY BY CHARLES H. PROCTOR.

The writer recently received the following letter from a well-known manufacturer of plumbers goods.

"We have had a difference of opinion that one of our customers as to what constitutes heavy nickel plating and in order to answer the question authoritatively, will you kindly advise us what would be good commercial practice in this particular case.

"We find that the platers always gauge their work by the length of time that the article is in the tank, but that none of them have any idea as to exactly how thick the deposit is and it is this point we would like to get at. In other words, if it is good commercial practice to give the article an hour in the tank, what would be the exact thickness of the deposit."

CHARLES H. PROCTOR

The above letter speaks volumes for the "rule of thumb" methods still in vogue in the majority of plating plants in the United States. Is the time not ripe for commercial standards? The manufacturers are not to blame when a customer finds fault with the wearing qualities of the product as it is sold upon the basis of cost and profit in manufacture. There is no commercial standard for electro-deposits and the United States Government has no standard of weights of deposits in their specifications for they depend upon the nitric acid tests, excepting in zinc plating and then the usual sulphate of copper test is applied to determine the wearing qualities or the thickness of the deposit.

The United States Government specifications for silver plate is a triple plate, though the thickness of a single plate has never been determined so a double, triple and quadruple plate is equally as vague. No weights per decimetre or square inch or even square foot have ever been substantiated so the consumer has had no means of gauging the thickness or quality of the deposit; the only guarantee being the honesty and good repute of the manufacturer and the best protection consists of buying goods made by houses whose reputation is established and whose faith is above question.

The wearing qualities of any electro-deposit depends upon its adhesive qualities and thickness. This is especially true of products that are constantly in use, such as plumbers' goods, the majority of which is nickel plated and must be continually polished to maintain its lustre which gradually reduces its wearing qualities. This is also true of silver plated flat and hollow ware, the base of which consists of steel, German silver, brass, copper, etc. There are no standards for these deposits, so a guarantee is of no value, unless it is possible to know for a certainty what the guarantee implies.

In the letter mentioned above a difference of opinion arises between the manufacturer and the buyer of his goods as to what constitutes heavy nickel plating. The manufacturer is unable to answer the question because he does not know what constitutes a heavy nickel deposit and therefore cannot state how much nickel should be used as a deposit on his product per square decimetre, square inch or square foot, but gives a product to his customer which he believes, as an honest manufacturer, is consistent with the price paid for it. The plater is equally in the dark as he plates his work so that it finishes well and does not cut through or show the base metal in the final finishing of the product by polishing. In many instances the work is loaded in the tank and the product is plated for an hour, but the plater has no visible means of determining how many amperes are being used upon the loaded tank, therefore, is unable to decide how much nickel is being deposited in one hour. It is the amperes that are consumed in one hour's time that tell the story of the deposit and not the time the product is in the tank. With no visible means of measurement the plater is ignorant of the amperes being used and the ampere law is infallible, and when correctly used it tells the story whether one or a thousand amperes are being used and this alone determines the thickness of the deposit.

But even the ampere law is of no avail unless there is a standard by which it can be determined how many amperes should be used in a given length of time upon a measured surface to produce a thickness of plate that will be accepted as a standard deposit. This is a matter for the building trades or the manufacturers association of plumbers' goods to take up and determine what thickness of nickel shall constitute a standard commercial deposit; the weight in milligrams per square decimetre or grains per square inch of surface to determine the wearing qualities.

It seems to the writer that the Bureau of Standards of the United States Government, should be the medium through which commercial standards can best be developed and that it should not be neglected any longer. Standardization is the true solution of many commercial problems and unless there is a standard in every line of manufacture our products will never reach the acme of perfection as that accomplished by such a standardized country as Germany. The electrical trades have some standards in the production of conduit pipes, which are mostly electro galvanized. The Underwriters specify that "the zinc deposited shall withstand not less than two one minute immersions in a saturated solution of copper sulphate at 60 degrees Fahr. The free acid shall be decomposed by additions of copper hydrate as long as free acid remains." If the base metal of the pipe, which is usually steel, shows a deposit of copper due to reciprocal decomposition, the pipe is rejected, as not having a standard deposit. The United States Government specifies that zinc coated or plated products shall withstand three one minute immersions in the copper sulphate solution as previously mentioned. The Western Electric Company has also standardized the deposition of zinc on their product which consists of depositing fifty milligrams of zinc per square decimetre which is equal to one-quarter ounce of metallic zinc per square foot of surface and will withstand three one minute immersions in a normal copper sulphate solution. This thickness of deposit is also accepted as a standard by other electrical manufacturers.

In the silver plate and holloware industry there is

presumably standards of single, double, triple and quadruple plate, but no specified weights accompany such designated standards. Is it not about time that there was some guarantee as to what such terms imply, some basis of weight which can be accepted as standard. In the flatware industry, such as the manufacture of steel silver plated knives and forks, the standard deposit is equal to twelve pennyweights of silver per dozen knives or forks. Figuring out the surface area of one dozen knives, the surface upon which twelve pennyweights of silver is deposited would be about equal to one square foot of surface. Twelve pennyweight deposits have been adopted as a commercial standard upon such products, though frequently heavier deposits are called for, but in many instances the deposits of silver are considerably less than twelve pennyweights; sometimes even as low as eight. When the knives are not stamped any weight of silver may be deposited under the terms of double or triple plate and still cover the law, which in reality is only the law of price and not that of value.

During the holiday season just past the writer purchased some gold jewelry from a very responsible dealer, but on examination found that the jewelry was not stamped, nor did it have the imprint of the manufacturer's name. It was guaranteed to be 14 karat and the cost of the article gave the impression that this was so, yet the only guarantee was the repute of the dealer, who had accepted the article at its face value from the manufacturer. Whether the article actually consisted of 10 or 14 karat gold could not be determined without analysis.

In no other country in the world are the laws regarding the intrinsic value of goods manufactured of the precious metals so lax as they are in the United States. Is it not time then that the consumer had some guarantee that when he purchased articles made up from the precious metals that he was obtaining the value for which he paid? Is not this the work of the Bureau of Standards? Also, is it not time for all karat gold articles to bear the official stamp of the United States Government and thereby guarantee its standard of value? Legitimate manufacturers would welcome such standards and only those manufacturers who are dishonest and who cheat and delude the public by inferior goods would be the losers because they would be forced to give a standard of value consistent with the price paid for it, or incur the penalty which should be imposed for using a Standard Mark without giving a standard of value.

Articles manufactured from gold alloys, if less than 8 karat fine gold, should not be stamped, for articles of less than 8 karat gold will not withstand the nitric acid test so the product would be questionable. The Bureau of Standards would accomplish splendid work in developing commercial standards for the benefit of the consuming public, for not only will government standards and guarantees prevent fraud, but such standards adopted and guaranteed by the United States Government will raise the manufactured product to a higher level and the commercial world will have a guide and the manufacturer a standard upon which to base the value of their product. By all means then let us have commercial standards in electro-plated deposits wherever possible and government standard marks on manufactured products of silver and the karat gold alloys. Manufacturers, dealers and consumers are vitally interested in honest values. The consumer must always pay the price, but how long will the American consuming public continue to let the dishonest manufacturer and dealer defraud him? Let the government then do its duty for after all governments are gauged in these modern days by their standards, whether for good or evil.

ELECTRICAL LOSSES IN A PLATING ROOM

A firm writes: "We are experiencing considerable trouble on account of our plating tanks being electrically grounded with the floor.

"The questions we would like answered are: First, can we eliminate the trouble without insulating the tanks from the floor other than by the wood cleats now used? Second, are there any insulators on the market that will successfully eliminate the trouble? Third, do other platers have electrical losses through grounding and is it a common or unusual condition? Fourth, would cleaning the metal salts off the sides of the tanks reduce the life of the tanks or give us the trouble of leaky tanks? Fifth, is it possible for the electrical waste to be due to a sum of small leakages from all of our tanks which amount to eighteen, or may it be one point that we have overlooked in our investigation?"

The cause of this trouble is due to grounding of the positive current with either water pipes that run into the solution or steam coils used for heating the solutions. These pipes then become charged from the solution because the solution is always charged from the anode circuit, which is positive. Unless there is a danger of short circuiting no trouble ensues, especially is this so where only one or two types of solutions are used, such as nickel or copper for instance; but if brass or zinc solutions are used in connection with a copper soultion then polarization may occur in the copper solution due to the zinc contained in the brass or zinc solution which sets up a counter current and the iron pipes in the copper solution become negative and will start to deposit metal from the solution. In such an instance isolation is necessary and insulated joints should be coupled upon each tank when iron pipes are in the solutions for heating purposes. Two such insulated joints or couplings should be used on each tank on the inlet pipes as well as the outlet pipes.

In answer to your several questions we submit the following: First, elimination of current loss can be accomplished by inlet and outlet couplings of steam and water connections. Second, insulators for this purpose can be procured from plating supply houses. Third, many concerns experience the same difficulty in grounding of the positive current. Only when "polarization" occurs, as noted, is there any direct loss of current. Many automobile electric systems are grounded direct with the positive current. In other words, grounding in plating departments is a common occurrence under similar conditions. Fourth, if the metal salts which have accumulated on the tanks are cleaned off it will increase the life of the tank and not decrease it. The salts become concentrated and attack the iron or wood of the tanks. Give the tanks a coating of either asphaltum paint or varnish once or twice a year. Fifth, electrical waste will only develop when a circuit is completed with a direct current such as polarization. Sixth, it is good practice to use hard rubber to the thickness of ½ inch beneath the wooden cleats supporting the tanks. Hard rubber will not absorb the acids or solution drops from the plating room floors.—C. H. P.

THE BRASS-ETTO OF THE BORGHETTO

A Trip Through Manhattan's "Brassville"

Written for The Metal Industry by L. Lodian, Manhattan.

Brondizium (the modern Brindizi) gave its name to the metal bronze; and Manhattan's east-side harbors the most cosmopolite brass-workers probably ever grouped together in a single city. Here some of the brass-goods stores still sell their manufactured goods by the pound—as throughout Slavdom. Thus, be it an ornate brass fender for the hearth, or an all-brass bath-tub, or a heavy candelabra or a set of table-spoons, they are scaled, and the purchaser is charged so much a pound. To accommodate American buyers, however, a price per piece or set is quoted. There is no system of marked or fixed prices; dickering or bargaining is the vogue,—at the expense of the novice!

A PORTION OF THE SITE OF THE ANCIENT BRONDIZIUM (BRINDIZI), FAMED IN ROMAN DAYS FOR ITS PRODUCTION AND WORKING OF BRONZE AND PERPETUATING ITS NAME IN THE METAL. THE MONUMENT MARKS THE TERMINATION OF THE OLD VIA APPIA FROM ROMA.

"NOTHING BUT BRASS."

Manhattan's little brass-ville or brass-town "hangs out" round Allen street region (under the elevated railroad) and on off streets. Between Canal and Delancey streets you will see more of the brass-world's manufactured goods in a concentrated space—in the various modest-sized stores—than in any other city of the globe—and I know 'most all of 'em, including Tyla (pronounced Tula) *the* brass-emporium of the globe. This is the Russian arsenal city some 150 Bepecti (pronounced Vercti) — 'round 100 miles — to the south-east of the old Ruthenia capital city of Mockba. Its inhabitants are as much given over to brass-working as those of another personally-familiar town—Essen—are to heavy ordnance *et al.*

Apropos of brassy Tyla—a few words, *en passant,* anent an incident which caused me to think somewhat along different lines.

I had been through the chief of its great *camobap* (pronounced çamobar) factories—places turning out by the mile those brass water-boiling urns for the tea-table you see all over Russiadom.

A couple days later I was visiting the brainy Tolstoi, per invitation, for a half-week's sojourn at his country estate at Iaznia-noliana—some 15 Bepecti to the south of Tyla, and told him of the trip through the brass factory, and mentioned the number of "hands" employed.

"Why do you say 'hands'?" said Tolstoi. "Laborers—human beings—are worthy of better designation than just 'hands.' Say *pabotniki* (workers) or employes."

Instantly I saw the point made by the master-mind!

That was nigh a score years ago.

I have never used the word "hands" (when speaking or writing of employees or workers) since.

Here in Manhattan's brass-etto the trade is grouped almost entirely on one street (and nearby off-streets) on the bazar principle of Asiatic cities. Kalikata, the teeming-million city of the Ganges delta, is a notable example of this—perhaps the best (and the worst conditioned) working illustration on the globe. I was familiar years ago with its brass and glass bazars, where you see every operation carried on in full view in the open (because of the heat)—working shacks. Even the dogs of the street would raise a howl in chorus because of my leisurely passing through the bazar to "see the sights"—such is their sensitiveness to the intrusion of a giaour (infidel) from the western world! Madras, Kalambo, Singapore, Tokio (Nippon), are minor examples.

The stores of the east side "brassville" are always well filled with goods, yet are always almost strangely quiet. Rarely are purchasers seen in them, and I have been more or less familiar with them for the past fifteen years. This is because they are chiefly reserved as show-rooms or warehouses for the goods. The trade-outlet is found via the big department stores and mail-order houses; or through those wily Fourth avenue "antique" dealers who will tell you anything to relieve you of your cash. One of the latter showed me a couple of small brass table-plates with the effigy of the Empress Ekaterina and Russian lettering. He claimed they were "17th century" work—and they "looked" it—and "were worth $25 apiece; but to you, times being dull, would make a special price of $15." This came down to $10, then to $8, then to $4, And all in vain!

"I only wished to know the price, not to buy." Such "antiques" are moulded by the hundred in the brass-etto (or fraud-etto), and the table-plate "antiques" instanced can be bought 'round 40c. apiece. They are sent all over the country to bric-à-brac dealers, for disposal to "collectors" with more dollars than sense.

'Tis said that in this world we all "make money more or less by false pretenses" (parsons included)!

"GOLD" TEETH A CENT APIECE

This is the ultra-"queer" among the minor products of Manhattan's "brassville." These cent-apiece brass teeth have been made the past score years, and are intended to fit over a tooth-stump (or otherwise defective dents) till

the wearer is ready for the odontologist. A tooth-stump, or split tooth, may last for years, and yet do its little in useful masticatory work. Writer has been using them regularly for over a decade, and nobody ever yet detected them to be of brass: so well do they simulate the gold article.

They are made of non-fouling composition: never have a "brassy" taste or odor; and are easily clamped into place per digit-pressure. Can be removed any time instantly, as for meals or before "turning-in"; and are easily kept clean and polished to a "24-karat" look. And in all these years' use of them, I never once knew the brass "goldies" to cause the slightest inflammation to the gums.

Many years ago an old man once said to me: "Never have your teeth drawn! Leave their ejection to the gradual work of nature. Besides, many persons have met death through unstoppable hemorrhages after extraction, or the setting-in of infections through the violently mutilated cavities in the gums."

The borghetto (generally abbreviated 'ghetto) "brass town" is, on a small scale, a permanent "international exposition" of brass working. You will see here a strange mingling of Asiatic brass-craft *motifs* with the Muskovite scheme of ideas, often termed "little Russia" work. Every conceivable form of the world's brass-craft, as illustrated in text-books, you will see in profuse variety in and off the Allen street brasseries. And more.

There are even brass table-gongs; brass teaspoons (no nickel deposit on them); brass pocket coffee mills (THE METAL INDUSTRY, March, 1915); brass jewelry; brass soup-tureens; brass drinking vessels in profusion; in fact, it cannot be said what they do not have in domestic furnishing articles (from candelabra to fenders and pokers and tongs and hip-baths *et cl.*) which is not of brass. One powerful reason for this is the east European and near-east idea of regarding brass as a metal "de luxe" over the metals for household articles, and as peculiarly appropriate for suitable gifts for the newly-weds; at baptisms; or for New Year's and other presents in general. (A hint to Americans: "Given to givin' ")!

One might think that such a promiscuous use of unplated brass culinary vessels might be prejudicial to health; but if that were so, whole races of the brass-using nations west and south of the Urals, and eastwards to the Tigris-Eufrates valleys, would long since have been poisoned "off the face of the earth." On the contrary, I have found that Asiatic and Ural region brassware was singularly free, even during warm-weather handling, of the disgusting, cantankerous "brassy" odor which is notorious of western-world brass goods after fingering during sultry weather.

Just as the Ural iron-workers, with their Russia black iron, have (after centuries of experimentation) managed to produce an iron singularly but not completely exempt from rusting; so have the brass-workers of the Slav and Saracin lands become proficient in producing non-fouling brass compositions, remarkably free from liability to verdigrising or malodorous "buké." Brass-town's hammered brass and bronze works, as exemplified in some types of the urns, braziers, bowls, flower vases, *et al.*, seen by the passerby in the windows, are often examples of clever craft-work, proving many years of constant familiarity with brass working.

By all manner of means let the American brass-lover make an occasional trip through the brass-etto of the borghetto, along Allen and off streets. 'Twill make him sadder and wiser! He can see all he wants to see in the windows. "It's free"!

COBALT PLATING

WRITTEN FOR THE METAL INDUSTRY BY C. O. BALTUS. AN ARTICLE DEALING WITH SOME NEW DATA ON THE SUBJECT.

The subject of plating with cobalt has received considerable attention[1] during the past year or two, due to the efforts of certain parties in Canada who are anxious to see a new field open for the consumption of cobalt which occurs as a by-product in the mining of silver.

Through the efforts of Dr. H. T. Kalmus, assisted by C. H. Harper and W. L. Savell, considerable valuable information has been obtained concerning the behavior of cobalt in plating solutions. This work is very completely covered in Bulletin No. 333 issued by the Department of Mines, Mines Branch, Canada.[2]

Following the suggestions outlined in the above bulletin the writer has conducted some experiments with cobalt plating with the idea of adopting the cobalt in the finishing of various articles placed on the market that are now finished with nickel. The information obtained in this investigation may be of some interest or assistance to others who are working along this line at the present time.

My first experiments with cobalt plating covered the use of solution No. 13-B as outlined in the above bulletin. This solution is made up as follows:

Cobalt Sulphate	$CoSO_4$	312.5 grams
Sodium Chloride	NaCl	19.6 "
Boric Acid	nearly to saturation	
Water		1,000 cc.

Total bath approximately 1½ liters.
Specific gravity at 15° C. approximately 1.24.

Cobalt anodes 2 in. wide by ½ in. thick by 8 in. long were used. These anodes had bevelled edges of about ¼-in. surface. The method of suspending the annodes in the solution was similar to that used with nickel annodes, a brass hook suspending the annode from the bus bar into the solution. An experimental tank approximately 18 in. wide by 24 in. long by 12 in. deep was used. Both the annodes and the cobalt salts used in these experiments were obtained from Harshaw, Fuller and Goodwin Company, Cleveland, Ohio. There was some question concerning the purity of these materials. Analysis showed them to obtain the following elements:

ANALYSIS OF COBALT ANNODES

Cobalt	96.76%	Check	96.83%
Nickel	1.28%	"	1.25%
Iron	1.17%	"	1.17%
Copper	0.27%	"	0.27%
Sulphur	0.08%	"	0.08%
Manganese	0.02%	"	0.02%
Silicon	0.10%	"	0.10%
Phosphorus	0.03%	"	0.03%
Carbon	0.15%	"	0.15%
	99.86%		99.89%

ANALYSIS OF COBALT PLATING SALT (COBALT SULPHATE).

Cobalt	21.02%	Check....	20.98%
Iron	0.07	"	0.07
($CoSO_4.7H_2O$.	20.97%	Co theoretically.)	

With solution 13-B used in the above experimental tank, I was able to deposit a cobalt plating in 4½ min-

[1] THE METAL INDUSTRY, March, 1912; June, 1915.
[2] THE METAL INDUSTRY, January, 1916.

utes (2,700 ampere seconds) which under a corrosion test proved to be as satisfactory as a two hour nickel plate (8,100 ampere seconds). In order to approve the value of cobalt plating as a means of resisting corrosion, the writer conducted an extensive test along these lines. Forty-eight pieces of cold rolled steel were plated with varying thicknesses of nickel and cobalt. These samples were all prepared at the same time, being cleaned by the same method previous to plating, the cobalt and nickel plate being applied immediately to the steel without any subsequent copper plating. The thickness of plate, the time of plating, and the ampere seconds used were as follows, as well as the estimated portion of the surface corroded when these parts were submitted to corrosion test.

		Nickel	Cobalt 100% Co.	50% Cobalt.	33 1/3% Cobalt.
Estimated Surface Corroded	Top ..	15%	4%	9%	16%
	Bottom..	22%	9%	12%	21%
Time of plating.....		2 hrs.	13.5 min.	6.5 min.	4.5 min.
Ampere seconds.....		8100	8100	4050	2700

In the above table, the 100 per cent. cobalt and the 50 per cent. cobalt and the 33 1/3 per cent. cobalt, refer to the thickness of plate applied to the respective samples as compared with a given thickness of nickel. In other words, with 8,100 ampere seconds, I obtained a definite thickness of nickel plate and a corresponding thickness of cobalt plate, whereas, with 4,050 ampere seconds, I obtained one-half as much cobalt as in the case of nickel and with 2,700 ampere seconds I obtained one-third as much cobalt as was the case with nickel. The parts plated according to the above table were all given a corrosion test which consisted in placing them in a horizontal position on glass rods in a chamber saturated with an atmosphere of a salt spray at all times. The plated parts were all submitted to this salt spray for a period of four days after which they were removed and carefully examined. The amount of surface corroded is noted in the above table, the results of which would indicate that one-third as much cobalt will give approximately as much protection as a given thickness of nickel plate. Assuming that the protection against corrosion obtained with one-third the amount of cobalt is satisfactory as compared with that obtained from the nickel, the rapidity with which this amount of cobalt can be applied is startling. In this connection, it should be noted that a plating shop handling 4,000 gallons of nickel plating solution with a total of 175 square feet of cathode surface having a capacity of approximately 4,300 such pieces as the above samples per day, would produce an equal amount of work providing they replaced this nickel plating equipment with one tank of 100 gallons of solution No. 13-B having a cathode surface of 7 square feet.

Above I have noted briefly some of the advantages of cobalt plating over nickel plating. It would not do, however, to pass this subject without mentioning some of the difficulties experienced with this material, particularly in reference to the finished plate. In order to determine whether cobalt would tarnish more rapidly than nickel, several samples were heated at various temperatures by means of an electric current. In all cases, the cobalt tarnished more rapidly than nickel. A sample of cobalt and a sample of nickel were placed side by side and were heated up in the air to a temperature of approximately 375°C. This heating was continued for a period of approximately one-half hour. The cobalt plated sample began to tarnish at a temperature of approximately 300°C., while the nickel showed no change at the end of the experiment. Feeling that the above tests might not be conclusive, heating tests were repeated using pure cobalt and pure nickel, heating the parts by the same means as noted above. In these tests, the cobalt began to color slightly at a temperature of approximately 200°C. when heated for a long period of time, while nickel showed no change when heated to 300°C. for the same length of time. Furthermore, cobalt tarnished objectionably at a temperature of 250°C. when heated for short intervals, while nickel showed practically no change when heated for short intervals at 350°C.

Continuing the above test it was noted further that the dark tarnish of the cobalt faded somewhat when heated at a high temperature. However, the final color of the cobalt is much darker than the nickel and for this reason there is very little encouragement in the substitution of cobalt for nickel in the finishing of ranges, flatirons, heating device parts, etc. An extended test is being conducted at the present time to determine if cobalt will tarnish at room temperature under ordinary atmospheric conditions. It will be interesting to note the outcome of these tests. I feel that the substitution of cobalt depends considerably on these results, particularly in its application to such articles as we are accustomed to nickel plate at the present time which are not heated in service. Providing cobalt stands up as satisfactorily as nickel over a long period of time, there is a great field for the use of this material on such articles as builders' hardware, clocks, and various cheap articles which can be plated in quantities where the length of time of plating is an important factor.

METAL WASTAGE IN WAR

From time to time one notes references to the prospects of "mining" in the battlefields after the war for the enormous quantities of metals daily scattered by innumerable shells. Calculations are made regarding the value of the copper and brass embedded in the soil by the violence of explosives. Our answer to these calculations will lessen the idea of adventurers or prospectors digging among the gruesome relics of warfare. A regularly organized salvage system has been adopted by the British and French armies, and possibly by the other belligerents. In each locality a British corps is at work carefully collecting and sorting out metals and everything else of value for subsequent sale. The business has assumed large proportions. After the war the authorities may glean afresh, and then probably forbid the digging up of certain lands which ought not to be disturbed for the purpose mentioned.

ANNEALING COPPER AND BRASS.

In annealing copper, and most of its alloys, the quickest method is quite a reversal of that adopted in dealing with steel. The metal, whether wire, sheet, or castings, is gradually brought to a full red heat, and then either air or water-cooled, in some cases more than one heating being desirable. This produces the greatest softness, but after being compressed by hammering or rolling, the metal becomes again hard, and the annealing process has to be repeated. Probably cooling in water gives the best results in many instances, but this is a point which can only be determined by experience. In any case, however, if not well annealed, the metal is likely to split under the hammer or roll, and it is quite easy to cause damage through lack of proper annealing.

SCIENTIFIC MANAGEMENT

MISTAKEN IDEAS OF EFFICIENCY ENGINEERING AS APPLIED TO IMPROVING MANUFACTURING RESULTS.

BY ENGINEER.

So much has been written and said about the direct increase in output per employee as the result of introduction and installation of efficiency methods, especially in manufacturing establishments, that in many minds it is accepted as a criticism and exposure of past inefficiencies, and even dishonorable efforts to conceal possible output on the part of such employees.

It is only natural that such disclosures should be resented by the people on whom they are intentionally or unintentionally made to reflect, and it is this attitude that is responsible for most of the opposition to the introduction of such methods, although it is largely influenced by the mistaken efforts of untrained or unwise enthusiasts who attempt extremes.

It rarely happens that changes brought about by the introduction of efficiency methods reflect in any way on past ability or integrity of the workmen affected by such changes, but almost invariably they indicate lack of proper and full consideration of the problems involved in the production of the goods by those higher up, and who only are responsible for the methods adopted and the policies pursued.

Even in such cases as it is disclosed that workmen have deliberately restricted output it almost invariably has been on account of an implied or outspoken policy on the part of the manufacturer to restrict the possible earnings of such employees.

As a matter of fact and generally speaking the rank and file of employees have little say in methods of procedure for the performance of their tasks, and are in no way responsible for the numerous interfering factors which are entirely within the control of those higher up who may be working under handicaps of lack of proper organization, equipment or other facilities even if competent and active in their efforts to obtain best results.

As illustrating these statements a few instances will be cited of the most readily understood character.

In one of our most progressive foundries, the moulders were all on a piece-work basis, and conditions and wages such that a large proportion of the help had been with the firm several years. Upon investigation it was discovered that many of the moulders had most of their allotted floor space filled with their work by noon, and from lunch to pouring time merely dawdled at their work to fill the balance of their floors. This condition was so obvious that a careful inquiry was made as to reasons that such men were not provided larger floor areas and encouraged to produce more.

The answer disclosed that these men through long practice had acquired such proficiency that if permitted to put up all that they might that the company would promptly cut the rate, so that these men would earn no more than at present, although doing much more. The superintendent rather than go through the harassment incident to such cuts and losing his skilled and competent help, simply shut his eyes to the obvious opportunities and left well enough alone.

And it is very doubtful whether the employers could have reaped any benefit had a more mercenary spirit been shown by their superintendent, on account of the expense of breaking in new men and the temporary lessening of output during these intervals of endeavor to train and develop men who would be satisfied to give extra service for ordinary reward. So long as the employers exercise a policy actual or implied of limiting employees' earnings the inevitable result is always limited output.

This limit of employees' earnings also manifests itself in day-work, premium and bonus methods, quite as frequently as in piece-work, and is the one big barrier to be eliminated in many concerns to secure maximum output, even with well formulated and executed plans for increasing the possible output of individual employees.

Another cause for limited output per employee is limited service to such employees along lines that permit each to work effectively and continuously on the primary tasks to which they are assigned or for which they are employed.

One large manufacturer decided to operate on an eight hour basis, changing over from nine, and as over 84 per cent of his pay-roll was on a piece-work basis he engaged specialists to go thoroughly over his rates and established them on as equitable a basis as possible, insuring equal or greater earning per eight-hour day then previously earned on the nine-hour day. In making the study for establishing the new rates so many instances of interference with production by factors beyond the employees' control were removed or minimized that there was a total reduction of 32 per cent of old rates, yet the employees earned 11 per cent more per eight-hour day than formerly in nine hours.

Some of the apparent gain is expended in better service, and considerable is paid to employees for time lost, for which they are not responsible, but even with this the plant is getting out more per man-day and at a reduction in cost and lessened equipment expense.

Now in this instance employees work no harder, but with more enthusiasm and intelligence, as their problems are reduced to such a small number of different things to know and to do, that they naturally concentrate on these few with resultant greater output.

All of this work, if it was to reflect criticism on anybody, it would have been on the management and organization above the rank and file, as the latter were helpless to cure the existing situation and were in no way responsible for time lost or frittered away in obtaining supplies, instructions, or attention to faulty equipment, and all the various factors that make the difference between a man producing a day's work or simply getting in a day's time. Very frequently the very methods introduced to stimulate help entail such cumbersome machinery to operate that it reacts against its very purpose.

A case in point is the very general practice in tobacco stemming (where piece-work hand labor is used), of stopping all hands from 1 to 1½ hours before quitting time each day to clean up and tally up the weight of stems stripped by each employee for the day.

The corps of inspectors and weighers required to insure against fraud and the lost time of the employees waiting their turn for credit, besides the elaborate clerical records, constitute a loss of available productive labor that is sizable and easily saved by proper plans of the people higher up. The stemmers are helpless, as they simply follow the rules laid down by their employers, yet when by elimination of this cumbersome method, for stimulating and sensible plans adopted in its stead an increase of 30 per cent or more per man hour is sometimes unjustly attributed to deliberate loafing on the part of the stemmers, previous to the change.

Among the common mistakes due to over eager efforts of in-expert or in-experienced people to obtain the maximum possible results from application of efficiency methods is failure to provide for irregular factors that limit or restrict the possible best output per prolonged period of time.

As instancing samples of such omissions very commonly made on drop forge and other hot metal handling processes, is failure to allow for the periodical suspensions of activity on part of the operators to cool off and recuperate from effects of continued exposure to the heat. Such omissions penalize the operators and are generally cited as examples of injustice when in reality they are due to ignorance on the part of the parties responsible for establishing the standards of output.

A still more serious mistake is failure to provide for the exceptional conditions and variations in materials, equipment and environment. Not only does this penalize workmen unfairly and unjustly, but also causes serious losses to employers through not informing them of conditions and variations that if brought to their attention might be eliminated or reduced and possibly provide a channel for reimbursement.

It defeats one of the principal purposes of the introduction of these methods if, for instance, a spoon-polisher is given a standard for production based on perfect material and no incentive offered him to disclose faulty material or handicapping conditions that prevent his reaching such standards at any time. Manifestly the operator is not to blame and should not be penalized. To do so or ignore his handicaps is not only a source of loss but makes one more opponent to rational progress in industrial development who would otherwise be an enthusiastic advocate and helper.

Another mistake is the ignoring of offered suggestions and ideas of those who desire to help, but may be so stationed as to be unable to get more than a superficial view of what is aimed at or desired. The failure to consider the human equation and in effect, tell the man at the bench or machine to hang up his brains along with his hat, produces a very serious class of objectors.

This mistake is too common among unfledged theorists who try to apply literally certain operating axioms that unless used with discretion create more harm than good. Any man who shows the least desire or disposition to think or use initiative in his work should be encouraged, even if he is not one of the elect chosen to supply the brains.

The discouragement or encouragement of this class of workers is entirely up to the higher-ups, and they alone are responsible for any failure to secure the benefits of all the latent abilities and ideas of an organization.

The quicker statements regarding improved records are changed from blunt assertions that "the men are producing more per hour than under the old methods" to the more illuminating and truthful one that "the organization has been taught how to let the men produce more per hour than they formerly were able to by their old-fashioned management or lack of management" the quicker will a large share of existing resentment towards such changes in management disappear.

Properly conducted, such changes always benefit employees, not because of their greater willingness, but because restrictions are removed, and to blame employees for past performances is just as unfair as to say that a horse used to be lazy when he hauled a load on the old dirt road six miles an hour, and now makes 10 on the new macadam.

METAL MELTING IN GAS FURNACES

At the annual meeting of the North British Association of Gas Managers, Mr. Ralph Halkett, of the Glasgow Corporation Gas Department, read a paper, in which he gave the following interesting particulars of the consumption of gas and the cost of melting metal:

The melting of metals was done most successfully with gas-fired crucible furnaces, and the type varied with the nature and quantity of metal and the purpose for which it was to be used. The most common types of furnaces used were the "tilting," capable of dealing with quantities from 120 to 600 lb., and the "stationary," in twin and single types, which would deal with quantities up to 200 lb. Each or all of these could work with gas and air blast at 2 lb. pressure, or with high-pressure gas at 12 to 15 lb. pressure. Copper, gun-metal, yellow brass, aluminum and many other metals of a similar nature could be melted in quantities from 60 to 600 lb., at a cost of 3.5 cubic feet per lb. of metal melted. Lower gas consumptions had been obtained, but the average given is for practical working.

The following results are the average obtained under working conditions when using 300-lb. tilting furnaces fitted with air blast, the metals melted being copper, gun-metal and yellow brass:

Average working hours per day....	10
" No. of melts of 300 lb. each = 5 melts.....	25 cwts.
" time of each melt.....	2 hours
" gas consumption per lb. of metal for casting.....	5 cubic feet
" gas consumption per lb. of metal for ingots.....	3.75 "
" life of pots.....	35 heats
" " furnace	6 months

It was considered that two tilted furnaces would do the work of six 150-lb. coke-heated pit fires, and the working costs averaged about the same as the six coke fires, but gas had the usual advantages, which were important.

Another set of figures had been given by a Glasgow firm—Messrs. Whyte, Thomson & Co.—and shows a considerable saving in the working cost experienced by them in using gas for power and manufacturing purposes.

By the old system (using steam power and coke for furnaces, melting brass and gun-metal)—

One year's account for power.....£75	($375)
One year's account for coke (coke at 16s. per ton) 60	($300)
£135	($675)

Average number of melts per day with coke, four.

By the new system (using 34 horse-power gas engine and crucible furnace)—

One year's account for power..... £49 14 6	($248.62)
One year's account for furnace (gas at 1s. 6d. per thousand, manufacturing rate) 55 4 0	($276.00)
£104 18 6	($524.62)

Average number of melts per day with gas, six.

Hence, we see a saving effected of £30 1s. 6d. ($150.37) with a 50 per cent. additional output.

THE CHEMIST AND THE BRASS-FOUNDER*

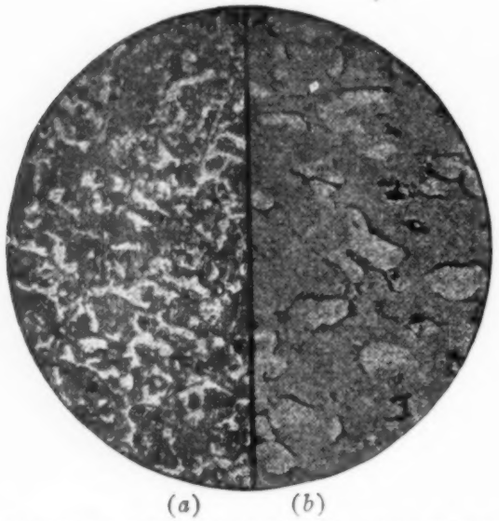
AN ENGLISH WRITER GIVES HIS VIEWS AS TO THE VALUE OF THE CHEMICAL CONTROL OF METAL PRODUCTION.

BY R. T. ROLFE, F.I.C.

(Concluded from November, 1916.)

BEARING METALS

It will be interesting to consider a few such alloys—taking first phosphor bronze. In our practice we use an alloy consisting of 85 per cent. copper, 14.4 per cent. tin, and 0.6 per cent. phosphorus, which is obtained by mixing 85 parts of copper with 15 parts of phosphor tin. It is used for dynamo and motor bearings. In its cast state, and with the composition indicated, the structure is very similar to that of Admiralty gunmetal, and is characterized by the presence of a considerable quantity of the stannide of copper, the eutectic constituent of gunmetal. For that reason it is weaker than gunmetal, the tensile strength



(*a*) (*b*)

FIG. 2.—PHOSPHOR BRONZE (*a*) ETCHED, and (*b*) OXIDATION TINTED. MAG. × 150 DIA.

generally ranging between 11 and 14 tons per square inch, with an elongation of between 1 and 10 per cent. In all cases where the proportion of phosphorus exceeds 0.2 per cent., the stannide of copper is always mixed with phosphide of copper, forming a double eutectic. The presence of the phosphide can be readily seen in the micro-section by the somewhat darker patches in the eutectic, while it is shown up much better by oxidation tinting, the phosphide turning to a dark blue, which appears black in photographing. These effects are shown in Fig. 2, *a* and *b*, respectively.

The ground mass is a solid solution of tin in copper. Copper phosphide is a very hard and brittle substance, while the solid solution of tin in copper is a good deal softer than even the stannide. It is thus evident that phosphor bronze possesses the characteristics of a bearing metal, consisting of hard compounds embedded in a softer ground mass, and as such it is used. The ground mass, however, being a solid solution of tin in copper, is much harder than in the case of the true bearing metals, the lead and tin alloys, and its plasticity is therefore much inferior. There is that tendency toward scoring already mentioned. It is, therefore, only used where it is possible to have extreme accuracy in adjustment—*i. e.*, in dynamo or motor bearings, where also there is only an even and regular rotary motion,—and for such uses it is quite suitable. Its special advantages are a low co-efficient of friction, great hardness, and great resistance to wear. During that wear the softer parts of the alloy are worn away, leaving the hard phosphide in relief. Thus the wearing surface is greatly reduced, together with the friction, while the rate of wear of the bearing is practically that of the hard phosphide of copper. Incidentally, that is why phosphor bronze is so valuable for the manufacture of the wearing parts if machinery, and lasts much longer than ordinary bronze. On the other hand, for a long shaft supported by several bearings, where there are several different forces at work, with perhaps uneven wear phosphor bronze would be quite unsuitable. It is not soft enough to mould itself to the shape of the shaft, and a more plastic metal, such as white metal, must be employed.

(*a*) (*b*)

FIG. 3.—ADMIRALTY WHITE METAL, CU. 6.5, S.B. 8.5, S.N. 85.0. (*a*) INGOT METAL; (*b*) FROM LINED BEARING, SHOWING SIZE OF HARD PARTICLES COMPARED WITH INGOT METAL. MAG. × 40 DIA.

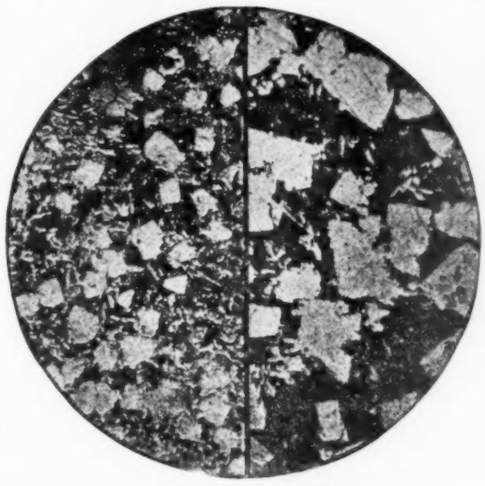
Lead is also sometimes added to phosphor bronze for bearing purposes. The resulting metal then consists of a number of very hard particles of copper phosphide and a number of soft particles of segregated lead, set in a ground mass of solid solution of tin in copper, thus fulfilling the requirements of a good bearing metal.

For engine bearings, the most important alloys have tin for their base. The British Admiralty, for example, specifies that the proportion of antimony shall be between 8 and 9 per cent., and the proportion of copper between 2 and 7 per cent., the remainder being tin. In this alloy, only two definite compounds are formed, one a compound of tin and antimony, crystallizing in well-defined cubes, and the other a compound of tin and copper, crystallizing in hard needles, which needles often group themselves into the form of stars. These two compounds constitute the hard particles which are embedded in the soft and plastic ground mass. The tin-antimony compound corresponds to the chemical formula SnSb and the tin-copper compound to that of $SnCu_3$. The examples shown in Fig. 3 contain about 6 per cent. of copper and a little over 8 per cent. of antimony. If the proportion of antimony be

*Read before the London branch of the British Foundrymen's Association.

increased, the crystals of the hard tin-antimony compound become more numerous, and a harder metal is, of course, produced.

In the example, Fig. 4*a*, containing, instead of the 8 per cent., about 11.5 per cent. of antimony, the copper being



(*a*) (*b*)

FIG. 4.—EXPERIMENTAL WHITE METALS.

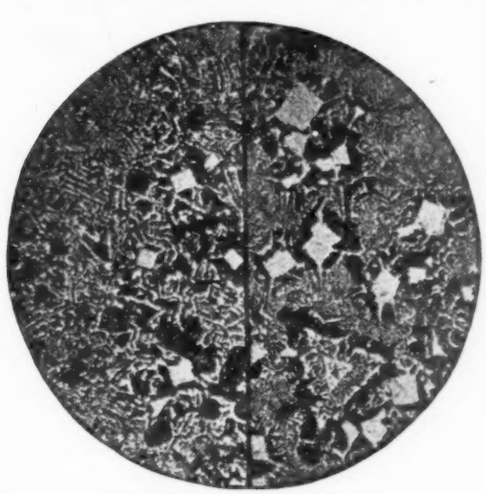
a—Cu. 6.5
Sb. 11.5.
Sn. 82.0.
Harder than (*a*) Fig. 3.

b—Cu. 6.0.
Sb. 20.0
Sn. 74.0.
Very brittle structure.

MAG. × 40 DIA.

the same, the grains, although much more numerous, are still isolated, and thus transfer the lead to the matrix in which they are embedded.

When, however, they become sufficiently numerous

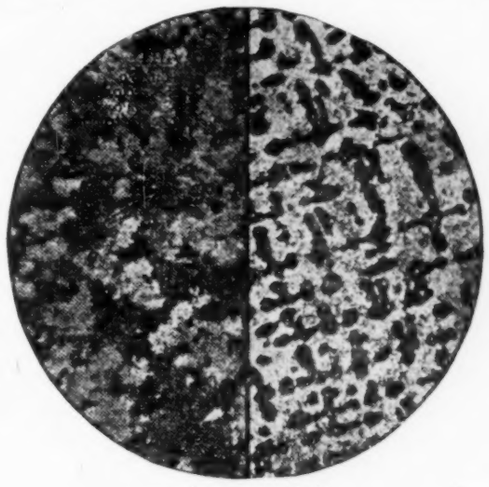


(*a*) (*b*)

FIG. 5.—ANTIFRICTION METAL, SN. 10, SB 10, PB. 80. (*a*) NORMAL; (*b*) SHOWING FLOTATION OF CUBES TO TOP OF INGOT. MAG. × 150 DIA.

to touch one another, they bear a portion of the load, and the alloy becomes brittle, and increasingly brittle as the amount of the plastic ground mass diminishes. In the example, Fig. 4*b*, of an alloy containing a large proportion, some 20 per cent. of antimony, at the expense of the tin, the cubes of the tin-antimony compound are in close contact with each other. If a strain is put upon that metal, there is very little of the plastic ground mass to take up the strain, and hard compounds slide on each other and the metal breaks at once. It is very brittle.

It is obvious that a good deal depends upon the number and size of the hard particles occurring in a bearing metal, and although there is not time now to go into the question



(*a*) (*b*)

FIG. 6.—(*a*) ALLOY OF 82 LEAD, 18 ANTIMONY, SHOWING BRITTLE STRUCTURE; (*b*) ANTI-FRICTION METAL, SN. 7, SB 7 PB. 86, SHOWING FREE LEAD. MAG. × 150 DIA.

of the exact sizes necessary, which sizes depend very much upon the casting conditions, it is apparent that one can tell by the microscopic examination of a bearing metal to some extent how it is going to behave in practice, and, conversely, when it has failed in practice, microscopic examination will frequently indicate what is wrong.

For example, take the case of the lead-antimony alloys. A well-known brand of anti-friction metal formerly contained about 16.5 per cent. of antimony, the rest being lead. Lead and antimony do not form any chemical compound with one another, but merely simple alloys. The lowest fusing point alloy, the eutectic, contains 87 per cent. of lead and 13 per cent. of antimony. If the antimony is present to the extent of over 13 per cent., then there are crystals of free antimony set in a ground mass of that eutectic. If there is over 87 per cent. of lead there are similarly crystals of free lead set in ground mass of eutectic. So, with about 16.5 per cent. of antimony, there would be a certain number of hard antimony crystals quite isolated from each other under normal conditions, and set in the eutectic ground mass.

If, however, the proportion of antimony exceeds about 20 per cent., the hard crystals become too abundant, causing the metal to become brittle. These cinclusions apply if the metal has been cast at the correct temperature, so that the antimony crystals are scattered evenly through the mass. It must be remembered that the antimony crystals are considerably lighter than the eutectic, and that therefore they will float to the top of the casting if the cooling be too slow. So that with less than 20 per cent. of antimony there is a danger of getting a brittle metal, and this occurs when the antimony may be as low as 18 per cent. The example in Fig 6*a* contained 18 per cent. of antimony. It was one that had broken in practice, and on microscopic examination the reason was evident. The hard crystals are in close contact with each other, giving the result one would expect.

As a matter of fact, pure lead-antimony bearing metals are not suitable for heavy loads, although I am afraid they are still used, with very unsatisfactory results, and when it is considered that there is this flotation trouble to contend with, which trouble is far more pronounced than in the case of most other bearing metals, it is obvious that

the use of these alloys should be discontinued, at any rate in all cases where the metal is subjected to heavy loads. Their rigidity is increased by the addition of either tin or copper. The addition of tin increases the rigidity and hardness of the metal without increasing its brittleness.

Although somewhat more rigid than the lead-antimony alloys, the lead-tin-antimony alloys are still not suitable for heavy loads, and they are restricted to such uses as for low-lift pump bearings. They are, of course, far cheaper than the tin-base metals.

In our own practice we use a metal containing 80 per cent. of lead, 10 per cent. of tin and 10 per cent. of antimony. The tin and antimony combined to form the usual hard compound, crystallizing in cubes (Fig. 5*a*), as was seen in the case of Admiralty white metal, and these particles are set in a soft ground mass consisting of a complex eutectic of lead, tin and antimony. It is, therefore, obvious that as some of the tin and antimony passes into the eutectic, unless a sufficient proportion of these metals is added, none of those hard cubes will be formed. The cubes always occur if the proportion of lead does not exceed about 81 per cent. When the proportion of lead become higher—say 85 per cent.—the miscrostructure shows free lead, occurring often as leaf-like crystals, set in the same ground mass as before. The alloy is still a bearing metal, consisting of soft particles of lead set in a somewhat harder ground mass, but not such a good one.

As in the case of lead-antimony alloys, tin-lead-antimony alloys require to be cooled fairly rapidly, in order that the lead may be evenly distributed. If not, there is that same flotation of the hard compounds to the top of the cooling mass (Fig. 5*b*). The question of correct temperature for lining bearings becomes thus a very important one. Care must be taken that the structure be neither too fine nor too coarse. The tendency, in alloys containing antimony, of flotation of the hard compounds to the top must be prevented by shortening the time of solidification. In general, the best results are obtained by pouring the metal at a temperature only very little higher than its solidifying point, into shells at about the temperature of 100° C. (see Fig. 3*b*).

THE END.

NICKEL

A BRIEF HISTORY OF THE NICKEL INDUSTRY UPON THE NORTH AMERICAN INDUSTRY.

WRITTEN FOR THE METAL INDUSTRY BY F. J. DICKIE.

The metal nickel, which is today the most sought after of perhaps any by reason of its value in war, and of which the Dominion of Canada possesses three-quarters of the world's supply within herself, has a remarkably interesting history.

It was discovered by accident, ignored for thirty years, and its final product was incidental and accidental with the furthering of certain Canadian copper mines.

In 1865, just sixty years ago, one John Salter, a surveyor, discovered nickel. He was traveling in northern Ontario when a sharp fluctuating of his compass made him pause. Investigating he found an immense "magnetic trap." An analysis of the ore from this showed copper and nickel. But no one knew anything of nickel in those days, and the find was ignored. Subsequently, in 1884, the Canadian Pacific Railway passed through the Sudbury region, and mining in copper in these regions followed.

However, in the early '80s nickel began to come into demand, and its value as a war material was nationally recognized by Germany in 1889, at which time the Krupps made a quiet effort to take all the Canadian supply for three years. However, the Ontario government realized dimly its possibilities, and in 1891 the great Canadian statesman, Sir Oliver Mowat, disregarding the usual formalities of correspondence, took this up with the British Government, pointing out the undoubted value of taking steps to thoroughly control this mineral. His offer was coldly turned down by the always conservative and slow moving English, and the possibility of controlling it was calmly ignored by them.

It was not until years afterward, in 1904, that the British Admiralty discovered how great had been their mistake in ignoring the offer of Canada. Then it was too late. Private corporations had secured control of practically the total field. The greatest of these was the International Nickel Company, which has been in operation since 1902, and is capitalized at $62,000,000. Practically all the nickel, though mined in Canada, has been until recently refined in New Jersey. Some idea of the growth of the nickel industry can be gained from the following figures:

	Output.		Output.
1890.....	$933,232	1905.....	$7,550,526
1895.....	1,360,984	1910.....	11,181,310
1900.....	3,327,707	1916.....	23,000,000

The shipment of nickel, that there is every evidence to prove came from Canada, on the German submarine *Deutschland* aroused the Canadian government to look carefully into the nickel question, and now Canada keeps close watch on the sale of it so that not a pound of Canadian nickel can go to an enemy power.

There are deposits of ore in New Caledonia, a French penal colony in the vicinity of the Antipodes. Germany has very small deposits in Saxonia and Prussia. The remainder of the world's supply in Europe comes from Finland, Sweden and Norway, but is almost negligible in quantity, the Norwegian supply in particular being of very low grade ore. In America there are deposits in Missouri, Pennsylvania, Virginia, North Carolina, and Oregon. But here, too, the ore is of low grade and the field not promising. There are also small deposits in southern Africa, Cuba and the Island of Lokris, a Greek possession. The last three places are very recent findings and may or may not prove important. A rough geological estimate places the so far discovered area in Canada to contain 100,000,000 tons of workable ore running from 2½ to 15 per cent. in nickel. How great is Canada's possession can be best gained by noting that in 1912 the world's entire supply was 26,500 tons, of which Canada, or rather the Province of Ontario, supplied 22,421 tons. Thus the rest of the whole world only produced 4,079 tons.

STRIPPING PLATINUM FROM GOLD.

A method that is being successfully used for removing platinum from gold is as follows: Prepare a solution of aqua regia by mixing three parts of pure hydrochloric acid and 1 part of pure nitric acid. Avoid an addition of water.

Immerse the articles containing the platinum in the cold aqua regia solution, and let them remain there until all the platinum is dissolved.

EDITORIAL

OLD SERIES
Vol. 23. No. 1

NEW YORK, JANUARY, 1917

NEW SERIES
Vol. 15. No. 1

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS' REVIEW, COPPER AND BRASS.
Published Monthly

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THE METAL INDUSTRY PUBLISHING COMPANY
(Incorporated)

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

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READING TRADE JOURNALS

THE METAL INDUSTRY has published a number of times various methods for getting the most out of a trade journal; that is, the different ways of studying the paper by everyone in a metal shop.

A method, however, which has recently been brought to our attention and which might be termed a checking up system of reading trade journals is as follows:

As soon as a periodical is received at the office it goes to the Sales Department where a printed slip is pasted on the cover. This slip bears the names of all the different departments and a blank space is left for the signatures of the head of each department, and the date on which he receives the magazine. The publication is first read carefully in the Sales Department and any articles, trade news or advertisements that are particularly interesting are marked. The journal is then passed on to the next department and so on in turn to each one when it is finally returned to its starting place in the Sales Department. Any articles or advertisements which have been marked for special attention are cut out and attached to sheets of standard size which are convenient for filing. They are returned to the department superintendent, who files them for reference. What is left of the magazine is put in place in the Sales Department and is not allowed to be taken from the files except upon the order of the department superintendent, who must sign receipts and see that the periodical is returned for permanent filing.

This method has been found to be very effective in preventing useful reading and advertising matter from being overlooked by any branch of the business, and in actual practice it has been found to assist in keeping the members of the organization up-to-date, for if one department head overlooks good matter he is apt to be caught by some other department chief who has seen the article in question.

This system of keeping tab of trade journals is used by Frank Krug of the smelting works of White & Brother, Philadelphia, Pa., and he reports that the knowledge gained by the employees from the careful reading of good trade journals adds so materially to their efficiency that the company considers that their time has been well spent. Also it is a method of weeding out and cancelling subscriptions to papers which are not worth while.

It is a means of reducing the number of useless publications with which the country is flooded at the present time.

The printed slips used for the system and pasted to the covers are as follows:—

	Department.	Date.	Signature.
1	Ingot.....	.....	.....
2	Copper Casting...	.....	.....
3	Copper Smelting..	.....	.....
4	Concentrating....	.....	.....
5	Shop	.....	.....
6	Laboratory.....	.....	.....
7	Sales	.....	.....

In conclusion, we wish that all firms would adopt this or some other good method of checking up, so to speak, the various publications received at their offices so that the good in them might become current knowledge and the poor journals thrown in the scrap where they belong.

By these means by virtue of a report that can be kept by the Sales Department, those interested can very readily arrive at the real value of any one journal. We know that this is being done at the present time, and we have been told that the results of such tests are surprising.

RETROSPECTIVE REVIEW OF 1916—OUTLOOK FOR 1917

The year 1916 certainly more than fulfilled all the predictions made for it at the close of 1915. There never has been a year, in the metal business at least, where so much prosperity has been in evidence. Metal has been and is king.

The Metal Industry in this the first issue of its fifteenth volume is glad to be able to record the results of such a wonder year in industrial development of the nation's resources.

The European war, of course, has been responsible in a large part for the wonderful impetus given to American business. Beginning with the demand for war supplies, consisting of army equipment of all kinds, munitions, motor trucks and ambulances, the lines of business not directly connected with the manufacture of war goods have gradually been stimulated until at the present time everything is running at full tide.

1916 has been a year of dividends and bonuses. There never has been a year in which such enormous sums have been earned and distributed, both to stockholders and workers, and there probably will not be another for some time to come. There certainly will not be, should the war's close come soon and no adequate legislation is soon put in force to meet the conditions that are bound to arise. The year 1915 can be termed a year of development and expansion, while 1916 has been a year of fulfilment.

The Metal Industry during 1915 told in detail of the many additions and increase in production of old concerns and of the establishment of new ones and the annual review of January 1916 gave a resume of these developments in the metal business, so that it is unnecessary to repeat them here. It is sufficient to say that we believe that as far as metal manufacturers are concerned there are now in existence ample facilities to meet all possible demands for some years to come.

METALS IN 1916.

1916 was the banner year in regard to prices obtained for metals. With all of the metals most in demand soaring at top notch at the beginning of the year it seemed as though the onward rush in metal production would never stop, but there is always a limit to human powers and now it looks as though the peak has been reached and the estimated production of metals for 1916 as shown on page 57 of this issue of The Metal Industry we believe will constitute a record that will remain unbroken for some time especially if the war should end within the next six months. The trend of prices for metal for 1916 is graphically shown in our chart published on page 58 of this issue and the causes for these prices are told in the Annual Metal Market Review given on page 54.

Some idea of the magnitude of the metal business of 1916 may be gathered by reading the reports of the activities of the concerns engaged in metal manufacturers. These reports are included in the Trade News Columns of this issue of The Metal Industry. Those from Waterbury and New Britain being especially interesting and illuminating. Another significant illustration is contained in the figures showing the exports of metals and metal manufactures from this country for 1916 which are as follows:

Exports of spelter and sheets made from domestic ore are estimated at 167,000 short tons, worth $52,200,000, compared with 118,603 tons, worth $29,537,680 in 1915. Exports of spelter made from foreign ore are estimated at 43,500 tons, valued at $7,500,000, compared with 13,720 tons in 1915. The exports of zinc manufactures fell off to $573,000 in 1916, from $2,173,089 in 1915. The exports of brass are estimated at 110,300 tons, valued at $65,085,000, compared with 33,136 tons, worth 12,435,906, in 1915. Manufactures of brass were exported to the value of about $237,300,000, compared with $41,117,771 in 1915. The value of cartridges exported in 1916 was about $59,000,000, as against $24,814,679 in 1915. The exports of domestic zinc ore were about 78 short tons, valued at $3,992, compared with 832 tons in 1915.

Copper was exported from the United States to the tune of about 60,000,000 pounds per month with a value of $15,000,000. In spite of the fact that it is reported that Great Britain has purchased copper for delivery during the first six months of 1917 at the rate of 80,000,000 pounds per month, it begins to look as though she had over-estimated her requirements and we can look to see some of this copper resold and never shipped. This opinion is strengthened by the fact that copper owed to Great Britain in 1916 account has not yet been shipped owing to lack of bottoms. These and other reasons incline us to the belief that the summit of consumption and consequently production and prices have been reached. By this we do not mean to imply that there will be a big drop at or following the close of the war. The indications in the past have been that consumers in their eagerness to cover for their wants and to enable them

to fill their contracts have bid against themselves so to speak, and this, together with lack of information from producers as to stocks on hand, has resulted in over buying. These things are beginning to be realized and conditions are settling down to a more normal and sane basis.

NOTABLE FEATURES OF 1916.

The big factors that have played a most important part in 1916 business have been shortage of labor and difficulty in getting prompt delivery of necessary materials both for construction and manufacturing. The first mentioned of these factors, that of labor, has been most serious. The cutting off of immigration has resulted in a big shortage of unskilled labor and consequently wages have gone up to an unheard of figure. Skilled labor has also had its demand met with in the matter of high wages, which, aside from the competitive feature, were in a large measure justified by the rising cost of living. In addition to this employes had to contend with other problems that greatly aggravated the shortage of labor. Many workers, all at once enjoying earning power far above anything previously experienced, can not stand prosperity. In some cases it is not only impossible to induce them to work over-time but some actually will not work full time throughout the week. Four or five days' pay more than suffices to meet their wants and the rest of the time is spent in buying and doing things they never had done before; thus increasing the demands on industry again. It is a sort of endless chain. Moreover, the general efficiency of the workers is decreasing greatly, so much, in fact, that employers find it difficult to estimate the wage cost of their products, and according to well authenticated reports, in some instances, there have been losses incurred where good profits had been estimated on the basis of experience of unit labor costs.

One of the most interesting and at the same time encouraging aspects of the relations of capital and labor in 1916 was the quite general tendency of the latter to voluntarily share profits with the workers. In past years this has, of course, been done but mostly in financial institutions, but lists of bonus paying firms published last December included names that had never appeared in any such role before. Hundreds of corporations, large and small, made distributions either in the form of voluntary wage increases or in the form of out and out bonuses ranging as high as 50 per cent. of the year's wages, and in a few cases even more than this.

What the future will hold for the general wage earner no one can say. It is certain, however, that the great majority will never go back to old standards without trouble. Living expenses of all kinds are up, and while there may be a slight reduction in the necessities of life there will be no return to low levels. The standard of living now enjoyed by many is so much higher than ever before experienced that it is going to be extremely difficult for adjustments to be made. That wages will go down is a foregone conclusion, for with the rush of immigrants to our shores that will be coincident with the close of the war, the shortage in unskilled labor will vanish like the fog before the sun. Then too, the slacking down of the large munition factories will release thousands of workers now employed at wartime wages and competition for work will soon bring down the rates.

The second factor we mentioned, that of shortage of materials, has been quite serious and still exists in some things. The metal manufacturers have come through in fairly good shape. This has not been the case however, with the producers of manufactured goods. Those concerns who maintain plating plants have had great difficulty in obtaining the chemicals necessary for the carrying on of their business. This has been particularly true of the cyanides of the metals, potassium and sodium. The latter chemical, cyanide of sodium, is largely used in mining operations, for the production of copper and silver plating baths and for various metal cleaning purposes. As very little potassium cyanide has been imported or manufactured here for several years the sodium salt has been largely in demand. As is well known, sodium cyanide is made by fusing the metal sodium with yellow prussiate of sodium, or sodium ferrocyanide. As this combination requires the reduction of sodium by means of electricity a cheap source of this power is essential. The principal manufacturer of sodium cyanide in this country has a large plant at Niagara Falls, N. Y., with the shutting off of the imports of cyanide, it became necessary for the American manufacturer to develop more electrical power in order to produce a larger amount of metallic sodium. The limit of power at Niagara Falls had been reached, so a petition was presented to Secretary of War Baker to permit of the production of additional power at the Falls. This petition was refused by the Secretary of War and this caused the manufacturers to look elsewhere. A large site with power has been procured and in a short time we are assured there will be cyanide enough for anybody, even if the war should last a long time. In the meantime we are sure that the article by C. B. Willmore, "Solving the Cyanide Shortage," published in this issue of THE METAL INDUSTRY will prove more than interesting to those who are concerned with cyanide production and uses.

OUTLOOK FOR 1917.

Judging from opinions expressed by leaders in financial and manufacturing circles the country is in very good shape for a prosperous year. A majority of the men who have been asked the question as to what percentage of our present prosperity is due directly to the war place it at between 25 to 30 per cent. The general theory as to conditions after the close of the war varies from a sharp depression lasting for a few months to a gradual falling-off extending over a period of years. On the whole, however, the feeling in regard to the future is optimistic rather than pessimistic. Of course, the attitude of capital toward business enterprises will tell the story when there is no longer a demand for war materials.

The United States in 1916 made great strides as an international money center. Today we are transacting business in a volume far beyond any thought of before

the war. We have imported over $600,000,000 of gold, have repurchased from abroad large amounts of our securities, have a balance of trade in our favor of about $3,000,000,000 and have invested about $2,000,000,000 in foreign loans.

As the signs of peace loom up on the financial horizon the question naturally comes up as to whether the United States having acquired its monetary dominance in time of war, will be able to maintain its pre-eminence in time of peace. But with such powerful resources as we have at our command our activities should not be crippled for lack of money!

CORRESPONDENCE AND DISCUSSION

WE CORDIALLY INVITE CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY

THE CRUCIBLE SITUATION

In order to throw some light on the conditions governing the manufacture of graphite crucibles used in the melting of metals the following letter was addressed to the varicus crucible manufacturers in the United States. The answers given below speaks for themselves and make interesting reading.—Ed.

THE LETTER.

GENTLEMEN:

Will you kindly give us your opinion as to the present conditions in the crucible field?

Also state what your idea is for the future. Whether the demand that at present seems to be in excess of production will finally be amply met with by present plants, or will the apparently necessary expansion in the business continue to grow.

Also tell us what the outlook is in reference to the price of crucibles. We understand that an average price of 16 cents per number now about covers the ground. Is this correct?

What is the outlook in reference to quality of the crucibles? Do you think that crucibles will be made finally in this country using American products, and will they have as long a life as the ones formerly produced using imported materials?

THE METAL INDUSTRY.

New York, December 17, 1916.

THE ANSWERS.

TO THE EDITOR OF THE METAL INDUSTRY:

We trust you will pardon our unavoidable delay in replying to your letter of December 17. However, in answer to your question as to our opinion of the present condition in the crucible field. To begin with, the demand for crucibles during the first six or seven months of the present year could not be met, due to shortage of plumbago, and we fully believe that all manufacturers are practically working, at the present time, on the first half of the year's business, and additional orders in the meantime have been piling up.

We hardly believe that the demand at present is in excess of the total production of the present manufacturing plants. With the new additions which most of the older manufacturers are putting up, we feel that all requirements of the coming year will be readily taken care of, providing, of course, plumbago shipments are not restricted.

With reference to crucible prices, these are likely to vary to a great extent as prices today are governed entirely by rates of ocean freight, marine insurance, etc. We have had quotations on this plumbago as high as 34c. per pound, whether it will go any higher is an unknown quantity. We do not know what the other manufacturers are charging for crucibles, but we have found it necessary to increase our price to 16c. per number on some sizes, and more than this on others, all depending, of course, on the cost of manufacture.

With reference to the quality of crucibles, we fully believe that this will be constantly improved. We are working with this end in view, and while the opportunity for experimenting is very limited, due to the general rush of business and lack of time to make the proper tests, we have not been able to get down to this point in a very satisfactory manner. However, we want to state that a great many of our customers have aided us considerably in trying to overcome the present difficulties, and we have greatly appreciated this, as without the co-operation of the consumer it would be almost impossible for the manufacturer to determine as to just what clays would give the most satisfactory results. We have just received a report on eight No. 20 retorts made from American clays that were charged with 700 pounds each, and which gave a general average of 47 charges. The retorts ran as follows:

No. 1	ran	61	heats
No. 2	"	45	"
No. 3	"	36	"
No. 4	"	40	"
No. 5	"	35	"
No. 6	"	38	"
No. 7	"	59	"
No. 8	"	60	"

and the parties who are using these retorts advise us that they expect to get more uniform runs when their labor becomes more skilled in the operation of their furnaces. The total metal melted in these retorts was 268,800 pounds. These retorts were run in the R. H. Engle metal distallation furnaces, with bituminous coal as fuel.

We are receiving numerous letters, together with orders, advising us to make shipment of our crucibles, "to be of the same quality as last," which, to our mind, indicates that they evidently have given satisfactory service. There is no doubt in the mind of the writer that if a sufficient opportunity was given the crucible manufacturer to develop American clay crucibles further, it is evident that there would be no use in the future of having to depend on Germany or any other country for clays for the manufacture of crucibles.

We have had reports, and we presume that other manufacturers have had the same, from the various foundries, advising that the crucibles they were using at the present time were just as good as any they ever used. The results today depend just as much on the handling of the crucibles and the time given them before charging to thoroughly anneal as they ever did, and we feel certain that if proper time and annealing were given the crucibles there would be very little cause for complaint.

JONATHAN BARTLEY CRUCIBLE COMPANY,
Louis H. Lawton, Secretary.

Trenton, N. J., December 23, 1916.

TO THE EDITOR OF THE METAL INDUSTRY:

Your letter of December 13, in reference to the crucible situation, received.

As you doubtless know, when the war started, the English government placed an embargo on shipment of plumbago from Ceylon to the United States, which remained in force until March, 1915. This caused the consumption of all reserve stock in this country, which has never been replaced, and also stimulated buying when the embargo was removed, rapidly exhausting supplies and tonnage in Ceylon.

Great difficulty has also been experienced in securing supplies owing to the great number of vessels taken out of this trade. The German vessels which formerly carried a great deal of the cargo have been interned, and the English government have commandeered many of their vessels. This situation is particularly severe just at the moment on account of the movement of India's wheat, and freights are advancing every day.

The clay situation has been equally acute, as all shipments from Germany have been stopped, and other sources of supply are not equal to the German in quality; nor have the producers been able to properly take care of the increased demand.

In addition to the above difficulties, the demand for crucibles suddenly increased enormously, due not only to the increasing of melting capacity of all users of crucibles, but also on account of inexperienced melters, reducing the life of the crucible, as well as the crucible manufacturer not being able to get the materials desired.

Additional crucible manufacturing plants will not relieve the situation, and we believe they are unnecessary. All crucible manufacturers have increased their production, and in several instances have enlarged their works to take care of the demand. So we believe the stringency in crucible is past, or soon will be, if the user orders only for their needs, and not endeavor to stock up; and will also exercise greater care in the use of the crucibles.

In reference to future prices, this is a most difficult question to answer, the cost of plumbago being affected by so many different conditions. The weather in Ceylon, vessels available for shipments, European demand for crucibles, new buyers in the market not understanding conditions, and forcing up prices on themselves and others, government taxes, etc., all affecting the price of plumbago. Prices today are higher than ever before known, and there seems to be no prospect of a decline in the near future.

McCULLOUGH-DALZELL CRUCIBLE COMPANY,
E. E. Arensberg,
Pittsburgh, Pa., December 23, 1916. Secretary & Treasurer.

TO THE EDITOR OF THE METAL INDUSTRY:

Replying to yours of the 13th inst., although it is a little late, with reference to the crucible situation, would say that we feel quite sure that the present demand, which, of course, is far in excess of production of crucibles, will eventually be met by the two or three new different plants which are now under construction, once they are completed. If it soon becomes possible to get German clay again, the present manufacturers should more than take care of the business, but as a matter of fact not one of the concerns making crucibles can turn one out with the use of American clay that averages over one-third of what the crucibles would if made of German clay, and in a great many instances about one-fourth. This in itself makes the demand three times greater than it would be under ordinary circumstances, if not four. You can readily see what this means the moment we are able to procure German clay again, as it is a positive fact that there is no domestic clay so far discovered in this country that is in any way to be compared to German clay. Although we hear that some makers profess to be able to turn out a crucible that will run equally as well, we feel that this is done for more or less of an advertisement, knowing as we do from our customers, who not only use our crucibles but every other make of crucibles, that all are about on a par and of very inferior quality in comparison to what they used to get.

Your understanding of the price per number being an average of 16c., is correct. This, of course, is governed by the cost of raw material, and not by the excessive demand. Graphite has continually advanced until it costs today over three times as much as it did two years ago, and all other material entering into the manufacture of crucibles in proportion; consequently only one result, and that is charging what we realize is an excessive price for crucibles in consideration of their quality; but this, of course, cannot be helped. We believe that every manufacturer is doing the very best he can in regard to the quality, as well as the price, and do not believe that anyone of them are taking undue advantage of their customers, and all are perfectly justified in charging the present prices.

BAY STATE CRUCIBLE COMPANY,
James M. Westgate,
Taunton, Mass., December 21, 1916. Treasurer.

TO THE EDITOR OF THE METAL INDUSTRY:

We are in receipt of your letter of the 12th, asking for information regarding the graphite crucible trade.

We would say that from the present outlook, as to the equipment and running of our new factory, that the first of the year will find the crucible production in a far better condition than it has been for several months, and there will be in 1917 all the crucibles that the trade can consume.

In regard to the price which will range on crucibles during 1917, this is problematical. We sincerely wish that the prices of raw materials would be reduced so that a more advantageous price could be given to the user. Whether our hopes in this direction will materialize or not, we cannot, of course, at present writing say.

Each week finds our chemists and engineers better able to cope with the clay conditions, and the reports which we are securing from both the rolling mills' casting shops and from the commercial brass foundries are becoming more and more complimentary each week. While we have not yet reached the standard of perfection which our crucibles were in the olden days when we used foreign clays, still our knowledge of how to blend the clays from the various sections of the country is a matter which we are becoming more and more familiar with, and the reports we are getting from the users in regard to the crucibles show that our experiments have been in the right direction.

JOSEPH DIXON CRUCIBLE COMPANY,
Al. Harris,
Jersey City, N. J., December 21, 1916. Crucible Department.

TECHNICAL INACCURACY

TO THE EDITOR OF THE METAL INDUSTRY:

In a civil manner I would like to ask if you have on your staff of manuscript readers any technically trained men, men who have a good general knowledge of chemistry and electricity, etc.? If I should write you an article on "Black Is White," "Nickel Sulphate Is Pink," or on some other topic the untruth of which is equally as self-evident, would you print such an article on the strength of the supposition that I knew what I was talking about, or would your technically trained staff return my manuscript as being unfit for publication?

My reason for asking these questions is this. Several times I have noticed articles in trade journals on "The Function of Boric Acid in Nickel Solutions" and "Depositing Brass, Copper and Zinc Upon Die Castings, Aluminum and Zinc from Cyanide Solution," which are not only absolutely chemically erroneous, but ridiculous in the extreme.

It is hard to believe that anyone can know so little about chemistry as the writer of these articles leads one to infer. It is not right that a trade journal having so many readers should accept and print such untruths, for there are always some men who are impressed by flowery language no matter how little truth the statements contain.—"CHEMICO."

WHAT IS NEW?

TO THE EDITOR OF THE METAL INDUSTRY:

In the November, 1916, issue of your valuable journal a very interesting article by Charles H. Proctor appeared entitled: "Necessity the Mother of Invention in Plating Operations."

I want to commend you for your business acumen for having a contributor on electro-plating processes of such wide and varied experience. What Caruso, Tetrazinni and Paderewski are to the musical world, Mr. Proctor is to the electro-plating fraternity, but I wish to call your attention to the following appearing in said article: "The alkaline zinc cyanide solution . . . has proven so effective in plating steel with zinc that manufacturers . . . are installing these solutions to take the place of the sulphate method."

It may be of interest and news to many who follow electroplating as a profession to know that the alkaline cyanide zinc solution is 62 years old. I have in my possession a copy of a patent for the process of depositing zinc on steel and iron electrolytically from a cyanide solution granted to Alexander Watt in 1855, and published in the *Chemist*, a publication edited at one time by the patentee and his brother.

Also I have a copy of a patent granted to Carl Endrumeit, of Berlin, for the production of metal papers or paper backed metallic foil corresponding to the process described in the above article. A description of the process was published in the *Electrical Engineer* in 1901. So I ask is there anything new under the sun? JOSEPH WALTERS.

Richmond, Va., December 3, 1916.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR, Plating-Chemical

ALLOYING

Q.—What can we use in order to make our copper alloy have a more reddish color?

A.—All we could advise would be to add more copper. Alloys of copper and zinc, where the zinc content runs from 41 to 43 per cent., take on sort of a red color, but they could not really be likened to an alloy having a high content of copper, and at the present time probably would not be as cheap as the high copper.—K. Problem 2,389.

CLEANING

Q.—We would like to know if there is anything that can be put in a potash solution to precipitate the lead which accumulates in it. We have a hot potash solution, which is used to remove the enamel from fenders, motorcycles and work of that character, and even if the articles are left in the solution but a short time, and are carefully washed, they become so leaded that it is quite a task to clean them properly for refinishing, and we would like to know if you know of anything which can be used to prevent this.

A.—There is nothing that can be put in a potash tank to precipitate out the lead without destroying the effectiveness of the cleansing properties.

Would suggest that the parts be cleaned electrically, that is, connect up the tank, if of iron, with the positive current and make the articles to be cleaned the cathode which should be connected with the negative current as in plating. If a nearly boiling solution is used the articles will be cleansed rapidly.

The lead can be deposited out when the solution is cold or slightly warm by using sheets of thin steel as the cathode. If the lead is found to deposit upon the articles when cleaning electrically, then arrange a double throw cross switch in the circuit so the polarity can be changed. The tank will then be negative and the articles positive.—C. H. P. Problem 2,390.

COATING

Q.—Can you give us any information as to how to make solder-coated gold? We desire to coat both sides of a strip of gold with solder. When the strip is finished it is to be .022 inch thick with a thin coat of solder on both the bottom and top sides. We are perfectly familiar with how to prepare the gold, and also how to make solder, but do not know how to apply the solder over the gold surface, say one inch by anywhere from one inch to twelve inches long.

A.—The method used by sheet-copper manufacturers may be applicable for the purpose desired. The method pursued by them is as follows: Coat the surface of the gold with a chloride of zinc flux to which is added a small amount of sal ammoniac, say 8 ounces per gallon of chloride of zinc flux. Lay the gold strips perfectly flat upon a flat smooth iron slab with some means of securing them to the iron slab and heat to the temperature of the solder. The iron slab should be placed on an angle of 45 degrees and a ladle of sufficient size should be arranged at the bottom of the inclined slab to catch the surplus tin. The gold should then be coated with the flux and the molten tin flowed over the surface of the gold by using a small ladle. As soon as the tin has covered the gold, wipe away the excess by using tow, such as plumbers use in wiping lead joints. To prevent the tin sticking to the tow and also to produce a smoother finish, apply a little of the flux to the tow. Repeat the operation on the reverse side of the gold. To produce an even surface, the copper manufacturers reroll the copper-tinned surface through the steel rolls.—C. H. P. Problem 2,391.

CORRODING

Q.—We would like to know what causes brass anodes to corrode in brass plating solutions. We do not think they should do this, and we have had to clean our brass anodes every time we use them.

A.—The coating upon brass anodes in a brass solution, which you term "corrosion," is either due to the formation of a basic copper carbonate if it is of a greenish color, or to a basic zinc carbonate if it is of a whitish tone; especially if carbonates of these metals are being used in replenishing the solution. The cause of such deposits forming on the anode is primarily due to the lack of free cyanide or a solution too dense in inert material such as an excess of sodium carbonates.

The remedy would be to reduce the density of the solution by removing about one-third and replacing it with clean water, then add about 1 to 1½ ounces more of cyanide per gallon of solution; that is, to the entire amount of the solution. The other additions that can be added to the solution to eliminate the coating are for the basic copper carbonate—1 to 2 ounces of sodium bisulphite per gallon of solution; for the basic zinc carbonate, ¼ to 1 ounce of caustic soda per gallon. If copper and zinc cyanides are used, the coating will not occur on the anodes. The carbonates can be regulated by the addition of small proportions of soda ash for conductive purpose.

The following basis for the use of copper cyanide as compared with copper carbonate can be used very successfully:

Sodium cyanide, 96/98%	12 ounces
(or cyanide mixture 74/76%—15 ounces.)	
Copper cyanide	11½ ounces
Soda ash	4 ounces

The above proportions will equal—

Copper carbonate	1 pound
Cyanide of sodium	2 pounds
(or cyanide mixture—2½ pounds.)	

On the basis of 1 pound of carbonate of zinc and 2 pounds of cyanide of sodium or 2½ pounds of cyanide mixture use—

Cyanide of zinc	1 pound
Cyanide of sodium	¾ pound
(or cyanide mixture—1 pound.)	
Caustic soda	2 ounces

These proportions will be found excellent for replenishing purposes, and will save cyanides.—C. H. P. Problem 2,392.

DIPPING

Q.—Kindly give me a formula for a gold color dip for brass fixture work in which no lacquer or no gold is used.

A.—Imitation gold colors upon brass can be obtained by immersing in the following solutions:

No. 1.

Water	1 gallon
Caustic soda	1¼ pounds
Copper carbonate	6 ounces

This solution should be used at a temperature of 120 to 180 degrees.

No. 2.

Water	1 gallon
Hyposulphite of soda	8 ounces
Acetate of lead	1 to 2 ounces

The temperature should be the same as solution No. 1.

The articles must be perfectly clean before immersing. The colors will not be permanent, however, unless lacquered after finishing.—C. H. P. Problem 2,393.

DEPOSITING

Q.—Could you give me a formula for depositing tin on the back of an electrotype sheel before it is backed-up with metal, thereby doing away with the use of tin foil.

A.—For the purpose intended use a tin solution composed as follows:

Water	1 gallon
Sodium hydroxide	8 ounces
Tin chloride	½ ounce
Corn syrup	⅛ ounce

Use the solution at a temperature of 200 degree Fahr., with 2 to 3 volts pressure. Tin anodes of pure straits tin should be used. A rapid deposit of tin is obtained with this solution.—C. H. P. Problem 2,394.

ENAMELING

Q.—We are having some difficulty in enameling on top of zinc plating. The following formula is used for the zinc solution:

Water	1 gallon
Sodium cyanide	3½ ounces
Zinc cyanide	4 ounces
Caustic soda	4 ounces

Three coats of white enamel are applied on the top of the zinc coating, and are baked at 160 degrees Fahr. After two weeks the enamel softens and peels off, and it seems to rot. We are also having difficulty in baking the putty on the zinc. We find that the zinc boils up and blisters at as low a heat as 180 degrees. Can you suggest a method of preventing this trouble?

A.—It is apparent that the enamel, which is probably made up from a lead base, re-acts upon the zinc and causes the trouble as noted. A size of some description is required upon the zinc before applying the enamel. Perhaps a thin coating of tupentine copal varnish would answer.

If a flash coating of copper was applied upon the zinc coating it would probably eliminate this trouble. Automobile wire wheel manufacturers have experienced difficulty in coating their zinc plated wheels with enamel, so they give the zinc plated surface a thin coating of copper in a hot copper solution. The following solution will answer the purpose.

Water	1 gallon
Sodium cyanide	3½ ounces
Copper cyanide	3 ounces
Soda ash (58%)	2 ounces
Sodium hyposulphite	¼ ounce

Temperature, 120 degrees and 4 volts.

After the articles have been zinc plated, they should be washed in water and then plated in the above copper solution for a minute or two, or until the zinc is uniformly coated with copper. Either of these methods should help you out.—C. H. P. Problem 2,395.

FOUNDING

Q.—Kindly advise what will prevent a crucible from sticking to the base block in a stationary air blast coke furnace when there is terrific heat? The base block is made of Woodland composition and the crucible is of graphite. Will powdered asbestos do? We have tried charcoal and powdered coke.

A.—We do not see why it is necessary to set the crucible down on a base block, but should think that a layer of coke put there on which to place the crucible would obviate the trouble.

If the flame is directed against the base block so that it is separated and will swirl up around the crucible, we do not think the coke would become sticky enough to cause the crucible to stick fast to the block. If it is not desired to put fuel on the block owing to the position of the blast, we should think that powdered asbestos and possibly mineral wool, which is cheaper, would answer the purpose, or two ordinary fire bricks which had been dipped in a mixture of fire clay would answer the purpose. If coke is used it should not be powdered, but rather coarse pieces make the best bed.—K. Problem 2,396.

GALVANIZING

Q.—Will you kindly advise how the flakey or crystalline appearance of galvanized iron is produced, and how the size and structure of same may be altered or entirely eliminated. We desire to know whether this is produced by adding certain substance to the zinc in the bath, or by some process of rolling or cooling after the coating has been applied.

A.—The crystal formation noted upon galvanized iron is due to the cooling of the metal after the iron sheets have passed through molten zinc. If a piece of solid zinc metal is fractured the crystal formation of the zinc will be readily noted. When galvanized iron is cooled quickly the crystal formation is liable to be somewhat smaller. The cooling process governs the shape of the crystal. If the metal could be applied in its molten state, and cooling could be accomplished in a vacuum or without atmospheric influence, the crystal formation might be eliminated; otherwise it cannot be changed or altered.—C. H. P. Problem 2,397.

RUSTING

Q.—Can you advise us what organic acid we need to keep the rust from collecting on our nickel anodes? Unless we watch it very close the rust will keep dropping down into the vat.

A.—To prevent the formation of rust upon the nickel anodes, which is probably due to an iron content in the anodes, citric acid will be found most suitable, as it reduces the iron oxide to citrate of iron which deposits with the nickel and produces a whiter deposit.

Citric acid has been used in Germany for many years as the most valuable of all organic acid additions in the electro deposition of nickel. From ⅛ to ¼ ounce of citric acid added to the solution occasionally will give the results desired. In making additions always use the minimum first, and also make it at night-time, and afterwards stir the solution thoroughly. In the morning the solution should be clear.—C. H. P. Problem 2,398.

PLATING

Q.—Kindly advise me as to the cost of nickel plating steel nuts. The finish should be rust resisting, and no doubt will have to be given a preliminary copper coating. Market conditions demand the cheapest possible plate, consistent with durability and production, will warrant the best possible equipment. Could cobalt be applied direct without a preliminary coat?

A.—The actual cost of labor for plating the steel nuts should not exceed 25 cents per thousand. Add to the labor cost incidentals such as chemicals, profits, etc. In quantities of 100,000 the cost should be to the prospective customer from 50 to 60 cents per thousand. The process of plating should be mechanical and accomplished in the following manner.

First, cleanse by tumbling in a solution of soda ash or any regular cleaning compound. Second, plate direct in a mechanical nickel solution after tumbling in the soda or cleaning solution; merely wash in clean, cold water. Plate from 30 to 60 minutes in a solution prepared of the following:

Water	1 gallon
Single nickel salts	10 ounces
Epsom salts	1 ounce
Boracic acid	1 ounce
Common salt	½ ounce
Voltage	8 to 10

Third, in drying out the nuts after nickeling wash in clean water, then immerse in a cold solution consisting of 1 gallon of water and 1 to 2 ounces of platers' compound. Dissolve the compound in a little boiling water first, then add the balance of the cold water. After a quick immersion in the cold compound solution, then immerse in boiling water. Rinse well and dry out in maple sawdust. As the drying operations can be accomplished so quickly by the methods outlined it will not be necessary to consider mechanical methods for this purpose.

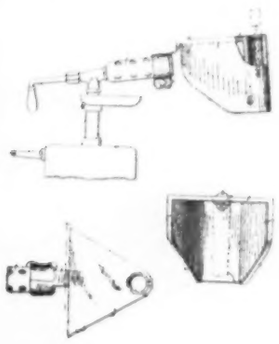
Copper plating will increase the cost of production. Slight deposits of copper only give a positive clean surface for the nickel deposit, and is by no means rust resisting. The nickel itself will prove more effective if the nuts are given a little longer deposit in the nickel.—C. H. P. Problem 2,399.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,201,497. October 17, 1916. **Melting Pot Attachment for Blow Torches.** R. J. Peschman, Fort Sheridan, Ill.

This invention relates to melting pots for solder, and has as its object to provide a novel attachment, shown in cut, for blow torches such as are used by plumbers, electricians and other workmen, which attachment will serve as a means whereby solder may be kept in a molten condition and in a manner convenient for use in soldering wires and other electrical connections.



In pursuing the ordinary methods of soldering wires and other electrical connections, the insulation of the connection or some adjacent object such as the nearby walls, ceiling or other support for the electrical connection is liable to be set afire.

The present invention therefore aims to provide an attachment of the class described so constructed that the two ends of the wires to be joined, or the other parts constituting the electrical connection, may be dipped into the molten solder to insure of their proper union, and without any likelihood of damage from fire.

1,204,131. November 7, 1916. **Soldering Apparatus.** John S. Clemens, Buffalo, N. Y.

The present invention relates to new and useful improvements in methods of and apparatus for electrical soldering, the primary object of the invention being the provision of an improved method, as shown in cut, of soldering in which the current employed passes through the solder being used so that as soon as the solder is removed from the work being operated upon the circuit will be broken and current thereby saved.

A further object of the invention consists in the provision of a soldering apparatus of such type that the heat electrically developed is developed directly at the part of the metals being soldered, thereby avoiding all waste of energy, due to loss of heat through conduction or radiation.

A further object of the invention consists in the provision of a soldering apparatus, the operation of which is not dependent upon the formation of an electric arc, and in which the pieces of metal being jointed form a portion of the heating circuit.

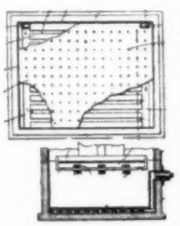
1,202,149. October 24, 1916. **Electrolysis of Tin and Its Salts.** A. E. Battle, Aldgate, London, England.

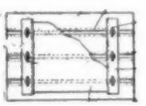
This invention relates to the electrolysis of tin and its salts, and has for its object the provision of an electrolyte that will enable the metal to be obtained from its ores, to be electro-deposited on iron, steel or other metals or metalized and conductive surfaces, and (or) to be recovered from the surfaces of other metals, as for instance from tinned plate, and other metalized and conductive surfaces.

According to the present invention tin or a salt of tin, as for instance sulphate or proto-chloride, is dissolved in ordinary phosphoric acid (ortho phosphoric acid) either concentrated or dilute. The salt may be dissolved in concentrated phosphoric acid and the solution used as the electrolyte, or it may be diluted by the addition of water or glycerin. Or the salt may be dissolved in water and phosphoric acid added. In this case a slight addition of phosphoric acid will cause some of the tin salt to be precipitated, so sufficient acid must be added to have an excess capable of redissolving the salt. The precipitation of the tin salt by the phosphoric acid in the case of stannous chloride may be prevented by the addition of a small quantity of hydrochloric acid, or in the case of stannous sulphate by the addition of a small quantity of sulphuric acid before the phosphoric acid is added to the solution.

1,203,802. November 7, 1916. **Apparatus for Etching Plates in the Photo Engraving Process.** J. J. C. Smith, Passaic, N. J.

This invention relates to apparatus or machines for applying etching fluids to plates in the photo-engraving process, the plates to be used for printing purposes as understood in the art, and the object of the invention is to provide an apparatus of this character which shall accomplish the etching in a uniform and rapid manner, and which apparatus may be constructed at a relatively low cost.

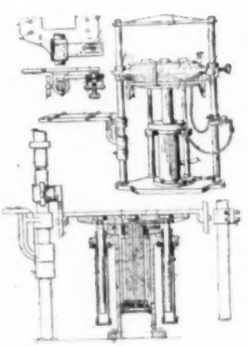




It may be stated that among the objections to the present methods and apparatus for etching plates by the photo-engraving process are (1) their high cost; (2) their lack of uniformity of operation upon the plate, particularly where, as is common, the plates to be etched are of considerable area; (3) the undercutting or widening of the lines of the design, and (4) the presence of moving parts exposed to the action of the strongly corrosive etching fluids which tend to rapidly corrode and deteriorate the same. The invention is designed to overcome these and other objections.

1,207,362. December 5, 1916. **Molding-Machine** J. M. Battenfield, Cleveland, Ohio.

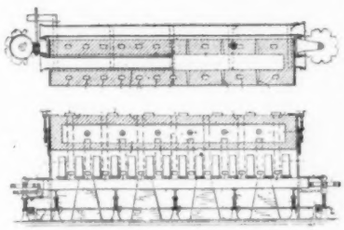
This invention relates to molding machines, the object being to provide a machine, as shown in cut, of strong and durable construction, providing mechanism for the jarring of the mold and the raising and lowering of the mold for the purpose of drawing the pattern, the parts being so arranged that a mold may be easily and quickly made, and the mold removed from the machine upon a swinging table, thus minimizing the danger of injury to the mold in handling.



The patent covers:

In a molding machine, the combination with a base, a cylinder secured to the base, a hollow piston within said cylinder, means for admitting and exhausting a motive fluid within the cylinder and beneath the piston to produce a jarring action, a raising piston within the hollow piston, a head secured to said raising piston, means for admitting and exhausting a motive fluid beneath the raising piston, whereby the head may be raised and lowered, and means for preventing relative movement between the raising piston and the hollow piston during the jarring action.

1,205,503. November 21, 1916. **Continuous Heating-Furnace.** Clarence D. Barnhart, of Brooklyn, New York, and William H. Jacobi, of East Orange, N. J., assignors to W. S. Rockwell Company, of New York, N. Y., a corporation of New Jersey.



This invention relates to a means, as shown in the cut, of treating a series of similar articles to heat the whole or a portion only of each article.

The invention is especially applicable to the heating of hollow shells or articles of steel, copper or brass to anneal one end of the same to facilitate some subsequent mechanical treatment, as flanging, or drawing the tube of the atricle to a greater length. Such treatment is practiced in the manufacture of cartridge cases by drawing the same into tubular form from a flat disk of brass. Such drawing operation is performed in a succession of steps each of which lengthens the tubular portion of the case and diminishes the thickness of such portion. Such drawing operation condenses the metal so that it is necessary to anneal it before it can be drawn again. In making such cases it is often necessary that the base should be unaffected by the heat, while the body or a portion, which is to be drawn, is heated sufficiently to anneal it, or a portion of the open end only is heated to facilitate the tapering of such end. The means for heating a portion of such an article may be used in such operations as annealing, tempering, hardening, coloring, and in some cases drying or baking such portion of the article.

1,206,075. November 28, 1916. **Process for Rust-Proofing Metal.** W. H. Allen, Detroit, Mich., assignor to Parker Rust Proof Company of America, Detroit, Mich.

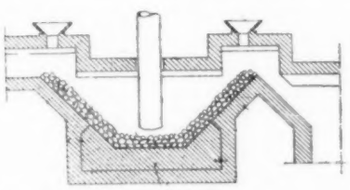
This invention relates to the rust-proofing of iron and steel, and its object is to provide a bath for the metal, which will cause the surface of the metal to be changed uniformly and without blemishes into insoluble basic phosphate, which is substantially unaffected upon exposure to moist air.

This invention is carried out by immersing the metal in a hot acid solution of a salt of manganese, preferably prepared by dissolving manganese phosphate in phosphoric acid. The manganese salt may be prepared by dissolving sulphate of chlorid of manganese in water and then adding an equivalent amount of sodium phosphate. The precipitate is then washed until practically free from sulphates and chlorids, and may then be dried if desired.

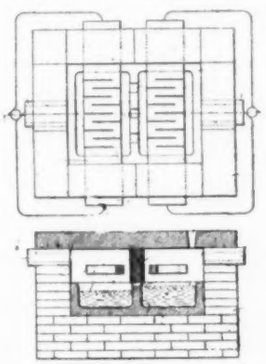
The manganese phosphate is then dissolved in phosphoric acid to saturation, and the solution is diluted to an acidity of about one-tenth of one per cent. The liquid is brought up to nearly the boiling point, and the metal articles to be treated are then immersed. A very small amount of the iron will go into solution, and some hydrogen will be set free, but after about one-half hour, this action will be very slight. The metal remains in the hot solution for from one to there hours, or until all action ceases and the surface of the metal is changed to basic phosphates which cannot be penetrated by the acid of the bath. The metal articles are then removed, dried and oiled or otherwise treated as desired.

1,207,127. December 5, 1916. **Method of and Apparatus for Obtaining Zinc.** Edward S. Berglund, of Trollhättan, Sweden, assignor to Trollättans Electrothermiska Aktiebolag, of Trollhättan, Sweden.

The invention has for its object to reduce the carbon dioxid and other oxidizing gases mixed with the exhausting zinc gases, and also to mechanically purify said gases before entering the condenser from powder of the charge, carried along by the gases, in order to facilitate the condensation of the zinc gases. According to the present invention a dust receiving and reduction chamber is arranged between the furnace and the condenser, as shown in cut, which chamber is only partly filled with carbor or another reducing material, over which carbon layer the gases are conducted. This chamber affords a free area of passage for the gases, and its size is such that the velocity of the passing gases is decreased to a sufficient extent to give the powder of ore and carbon carried along from the furnace ample time to settle, while the carbon dioxid will have time to become reduced, before the gases enter the condenser. As the same advantage is thus gained as by conducting the gases through a layer of carbon, while the disadvantages of that method are avoided, the present invention comprises an improvement of considerable value.



1,208,257. December 12, 1916. **Method of Separating Fumable Metals by Practical Distillation.** J. Thompson, New York, N. Y., assignor to John Thompson Press Company, Jersey City, N. J.



This invention pertains to metallurgy, and particularly to that group of non-ferric metals, in common commercial use, capable of being fumed or vaporized at a comparatively moderate temperature, such for example as zinc, lead, antimony, cadmium, etc., and one object of the invention is to separate an alloyed compound of metals into its constituent elements.

The method and means, as shown in cut, which are the basis of this invention, essentially involve, firstly, simultaneously heating two baths of fumable metals at or about the boiling temperatures of each metal; secondly, charging the alloy only to the basin, which is acted upon by the lesser temperature; thirdly, supplying the basin which requires the greater temperature wholly from the basin containing metal at a lower temperature; fourthly, causing the metal in both basins to fume or vaporize by electrically incited resistors whose heat is uniformly transferred to the upper surfaces of the baths by radiation, and fifthly, separately leading off and condensing from each bath the fume developed thereat.

1,207,845. December 12, 1916. **Acid-Proof Coating for Metals.** E. B. Bonstein, West Pittston, Pa.

This invention has reference to compositions, and its object is to provide an acid-proof compound to serve as a coating for metals.

The compound of the present invention consists of rosin as the body material, alcohol which serves as a solvent for the rosin, and oil of turpentine, which imparts to the solution sufficient elasticity to permit the ready application of the mixture to metals by means of a brush and the adherence of the mixture to such metals.

The composition is made up in the proportions of seven quarts of alcohol, one quart of turpentine, and eleven to fifteen pounds of rosin. Denatured or wood alcohol may be employed, and it is possible to substitute other solvents of rosin for the alcohol, but such solvents, and especially highly volatile hydrocarbons, are dangerous to use in mines where the fumes may readily catch fire and cause disastrous explosions.

1,207,858. Decembre 12, 1916. **Composition of Matter to Be Used for Preserving Graphite Crucibles.** J. B Carmichael, Seattle, Wash.

This composition consists of the following ingredients as stated, viz.:

Pulverized glass	18 ounces
Pulverized pumice	9 ounces
Saturated solution of sodium silicate	1 quart

First, the pulverized glass and the pulverized pumice are thoroughly intermixed and then disposed in a suitable vessel whereupon the saturated solution of sodium silicate is then poured into said vessel, and thereupon said ingredients are thoroughly mingled by agitation.

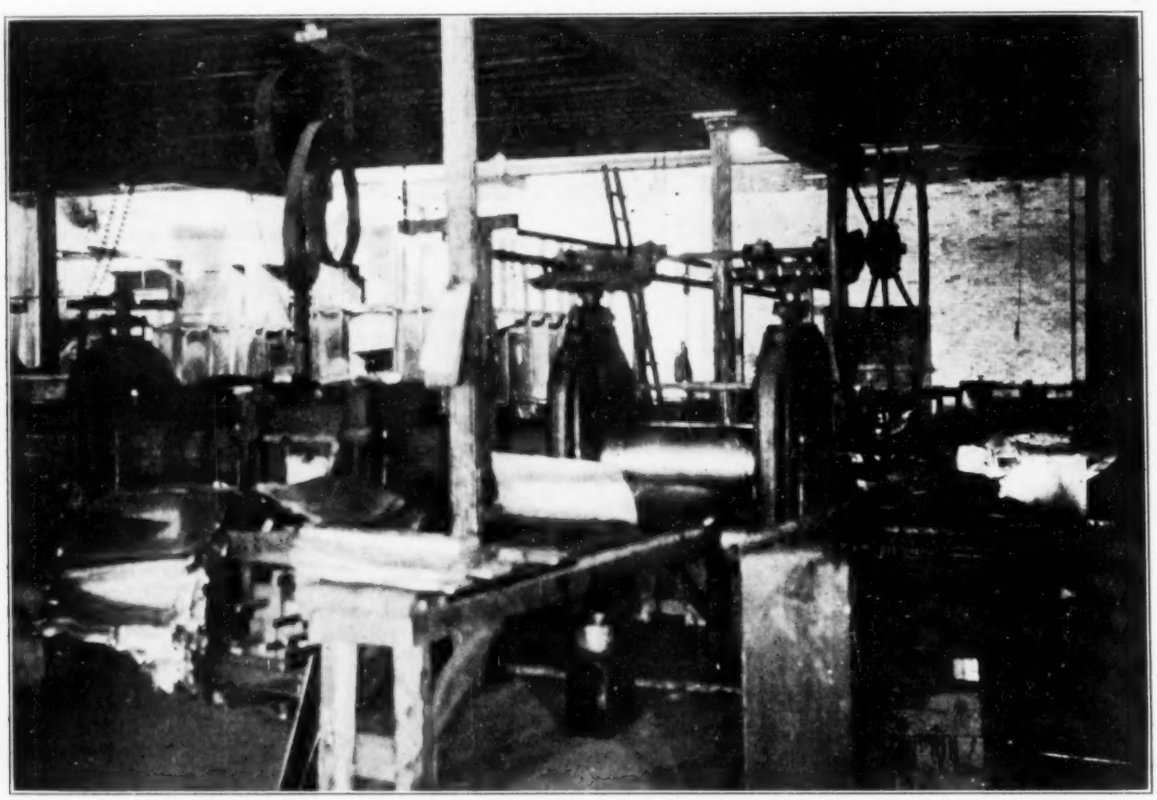
EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

AN ALUMINUM PLANT

A DESCRIPTION OF THE SMELTING, REFINING AND ROLLING MILL PLANT OF THE UNITED SMELTING AND ALUMINUM COMPANY, NEW HAVEN, CONN.

The plant of the United Smelting & Aluminum Company, situated at 189 Commerce street, New Haven, Conn., consists of a two-story brick building, with a frontage of 200 feet by 100 feet deep. The total floor space included in this plant, together with the basement, is equal to 55,000 square feet. Beginning with the basement the floors of the building are taken up in the following manner:



A VIEW IN THE ALUMINUM ROLLING MILL OF THE UNITED SMELTING & ALUMINUM COMPANY, NEW HAVEN, CONN., SHOWING THE 14 X 30 INCH BREAKING DOWN AND ROUGHING ROLLS.

Metal dross and slag department, where furnace dross and slag are treated and refined, is located in the basement. On the main floor extending the entire width of the westerly wing of the building is the foundry room, where 20,000 pounds per day of ingots, rods, granules and billets of aluminum are turned out. The rolling mill occupies the entire easterly wing of the building, and here are also located furnaces for melting rolling billets, annealing furnaces and latest type labor-saving rolling mill machinery.

The rolling mill equipment consists of the following: Melting furnaces for the rolling mill billets, with a melting capacity of 5,500 pounds of molten metal, and fired with indirect flame from the fire chamber. There are 20 molds placed seven feet from the tap hole of the furnace, and these molds are of the tilting type, and the metal is carried forward by an overhead trolley way. The roll train in the rolling mill consists of three sets of rolls, which are driven by a 100 horse power motor direct connected by a series of gears. The first pair or breaking-down and roughing rolls are 14 inches in diameter, with a 30-inch face. The second pair of sheet finishing rolls are 14 inches in diameter by 36-inch face. The strip rolls are 14 inches in diameter by 16-inch face. These rolls are equipped with Blake & Johnson block coilers and with a patented safety guard, so that coils all gauge straight. A set of United Engineering & Foundry Company's squaring shears are used for shearing long and heavy sheets and plates up to 10 feet in length. These shears weigh about 18,000 pounds.

There is also a set of Niagara squaring shears with a 5-foot cut for squaring all sizes of sheets. There is a Niagara circling shear cutting circles from 6 inches to 6 feet in diameter, and there is a roll flatener with 4-inch diameter, 54-inch wide rolls suitable for rolling all gauges of sheets. The mill is equipped with strip cleaners, wood saws and one set of Blake & Johnson gang slitter, with a 30-inch arbor for cutting strips from ½ inch to 24 inches wide.

On the upper floor of the building in the westerly wing are to be found a laboratory and metal preparation department where iron and other impurities are separated from the raw material. The easterly wing contains the circling department, rolling mill slitting department, wire straightening and coiling department. The foundry proper contains three oil reverberatory-type melting furnaces, with capacities of 3,000 to 6,000 pounds of molten metal per charge, and all of these furnaces are

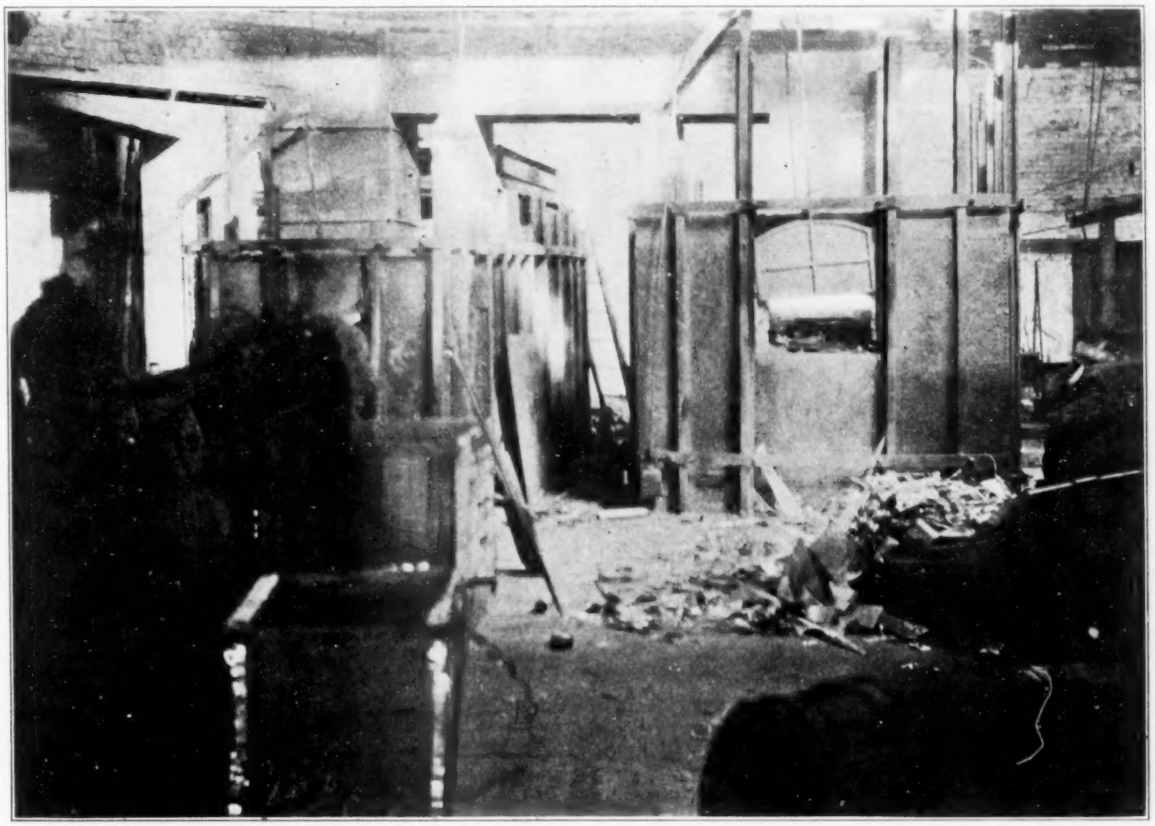
fired with indirect flame from the fire chamber. A Gilbert & Barker centrifugal air compressor of 1,000 cubic feet capacity at 1½ pounds pressure operating 3,450 r. p. m., with a rotary oil pump gear connected, is used to furnish the air pressure and the fuel for the furnace.

The shipping department of this plant is located in the westerly wing of the building on the ground floor, and occupies 2,000 square feet of floor space. From here are shipped all of the material produced by this concern, and in the stock room are stored the stocks of new aluminum sheets, circles, moldings, ingots, bars, etc., that may be on hand.

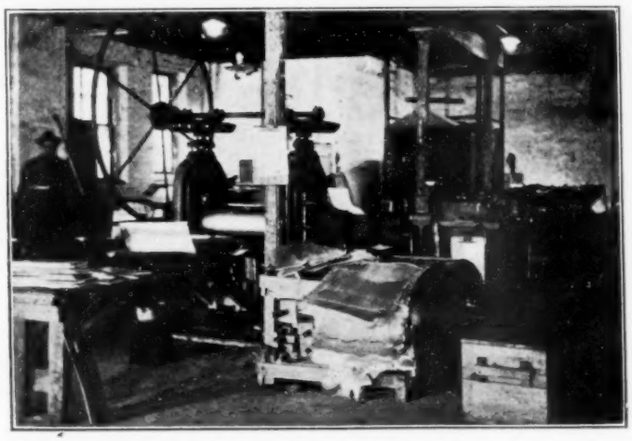
Before any of the product of this concern is shipped it is passed through a system of the most rigid inspection. Any sheets or other material showing the slightest fracture or dent, or being in any way imperfect, are thrown out by the inspectors. All of the sheet metal made by this company is claimed to be made from strictly number one virgin aluminum ingots, and the sheets are made to any size, gauge and temper required by the customer.

The products of the United Smelting & Aluminum Company include the following: Pure aluminum ingots, alloys, sheets, circles, coils, rods, moldings and shapes, granulated and powdered aluminum and shot aluminum.

The company is building a new plant to contain about 100,000 square feet of floor space at Hamden, Conn., which will be equipped with the latest and most modern labor saving machinery. A spur track extending 1,000 feet on the Hartford division of the New York, New Haven & Hartford Railroad is being built. The officers of the company consist of Harris Lapides, Louis Lapides, Abe Lapides, Michael Lapides and L. M. Brile, who is sales and advertising manager. The company has offices at 24 Stone street, New York, in charge of C. J. Wolfe, and at 1334 Dime Bank building, Detroit, Mich., in charge of E. S. Christiansen, manager, and W. T. Schmitt, assistant manager.

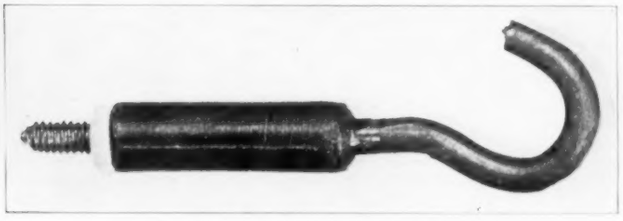


A VIEW OF THE REFINING FURNACES OF THE PLANT OF THE UNITED SMELTING AND ALUMINUM COMPANY, NEW HAVEN, CONN.



THE SHEET ROLLS 14 × 36 INCHES AT THE PLANT OF THE UNITED SMELTING AND ALUMINUM COMPANY, NEW HAVEN, CONN.

THE INSUL-BAKE PLATING HOOK



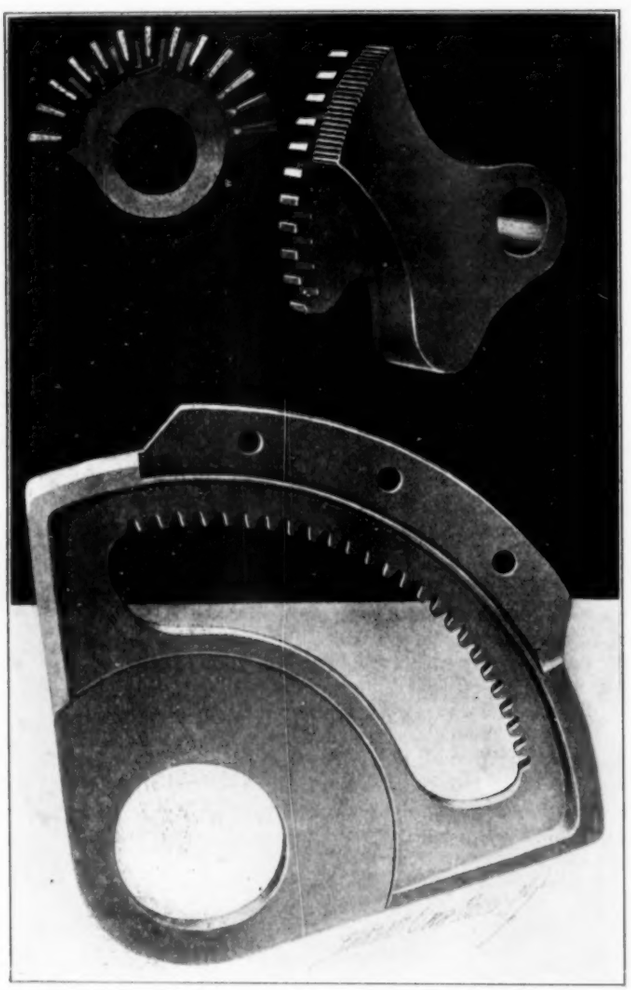
THE INSUL-BAKE HOOK.

THE SUCCESSFUL PRODUCTION OF BRASS AND BRONZE DIE-CASTINGS

By Charles Pack, Chief Chemist and Metallurgist, Doehler Die-Casting Company, Brooklyn, N. Y.

The writer has in previous paper covered the status of the die-casting industry.

At the beginning of the year 1913 all die-castings that were being produced commercially were composed of either tin, lead or zinc base alloys, about 90 per cent of all castings used being



NOTABLE EXAMPLES OF BRASS DIE CASTINGS.

the latter type. There were so many limitations to the universal application of die-castings made from these alloys to the general engineering practice that the Doehler Die-Casting Company, of Brooklyn, recognized as one of the leading producers along this line, decided upon a series of experiments having for their object the improvement and extended application of the die-casting.

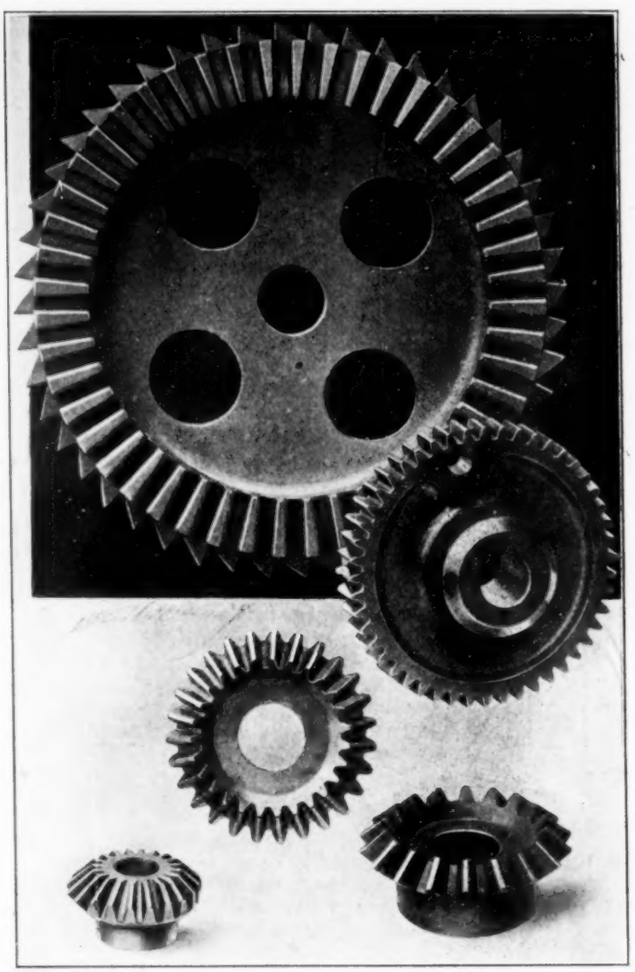
The Engineering and Metallurgical departments of this company were given unlimited financial support, and the following facts show to what extent their experiments were successful. Their research was divided into four branches:

1—Improving the zinc alloys then in use.
2—Elimination of air holes.
3—The die-casting of aluminum and aluminum alloys.
4—The die-casting of the higher fusable copper alloys, i.e., the brasses and bronzes.

IMPROVING ZINC ALLOYS.

During the infancy of the die-casting industry very little attention had been paid to the metallurgical phase of the process alloys were mixed without regard to metallurgical principles. The chemical and physical testing of the raw materials entering into the alloys, or of the mixed alloys was not dreamed of, nor was there any systematic control of temperature during mixing or casting. To the fact that these conditions do still exist in most die-casting plants must be attributed the fact that so many manufacturers have met with serious difficulties in their attempts to use die-cast products.

The Doehler Company operating plants in Brooklyn, Toledo and Newark, now employ ten well trained chemists, who supervise the mixing of the alloys and test all raw materials. The alloys are mixed in large pots that have a capacity of 10,000 lbs. The temperature during mixing is controlled by automatic recording pyrometric outfits. The recording end of the pyrometers are situated in the chief chemist's office, the galvanometers being placed in the pouring room so that temperature readings are visible to the furnace tenders. Every heat of metal mixed is marked with a serial letter and tested both chemically and physically before using. The temperature in the casting machines proper is controlled by an automatic thermostatic device designed by our engineers for the purpose, which absolutely prevents overheating of the alloy during the casting operation. Only virgin metals are used in compounding alloys and they are tested for any objectionable impurities. At definite intervals castings are cut up and analyzed as a final check on the process.



BRASS DIE CASTINGS MADE BY THE DOEHLER PROCESS.

Die-castings made under these safeguards have known and definite properties and when used in practice within their legiti-

*Transactions, American Institute of Metals, 1914, 1915, 1916.

mate sphere of application will show a saving without any year of a "come-back."

ELIMINATION OF AIR HOLES.

It is a well-known fact, although very reluctantly admitted by some manufacturers that die-castings cannot be made as solid as sand castings. The reason for this is very simple. Die-castings are made by forcing metal into a steel mould under high pressure. The steel mould, unlike the sand would, does not allow the air to pass through it. The metal chills almost instantaneously in the metal mould, trapping air unless SUITABLE VENTS ARE ALLOWED IN THE DIE.

The writer has at various times seen the announcement of some manufacturers that have devised a new process of die-casting whereby air holes are entirely eliminated. The manufacturer who publishes any statement of this kind is either guilty of an attempt to fool the consumer or lacks knowledge of the fundamental principles involved in the process of die-casting.

Every part has its individual shape and requires individual attention and study. By careful and concentrated attention on some parts, the gates and vents may be so located as to insure a solid casting. As an illustration, the bearings produced by the Doehler Die-Casting Company may be cited, years of experiment were required to produce a uniformly solid casting of this apparently simple shaped piece. This was accomplished by a careful study of gating and venting conditions. But it is absolutely misleading for any manufacturer to claim that because he uses a fabuously large pressure or vacuum that he can produce a solid casting. In fact, there are many instances in die-casting practice where lower pressures will produce much denser castings and many cases where a vacuum is a decided disadvantage.

The writer claims that the Doehler process for die-casting is the equal or superior of any other die-casting process, inasmuch as the solidity of the casting is concerned. The writer also claims that no die-casting process can be said to produce solid castings simply because a higher pressure or vacuum pressure is used. Finally, the writer is of the positive opinion that only by a careful study of the gating and venting of every individual die can a casting of maximum density be obtained. The Doehler Die-Casting Company have a trained staff of engineers who make a study of their die construction and thereby insure castings of maximum density.

ALUMINUM DIE-CASTING.

In January, 1914, the Doehler Die-Casting Company first exhibited their aluminum die-castings at the New York Automobile Show. Many attempts had been made before that time by this and other companies, but met with indifferent success. In most cases attempts were made to reduce the melting points of the aluminum by alloying with zinc, tin, etc. The Doehler product, however, was made from pure United States aluminum and electrolytic copper, containing approximately 8 per cent of the latter. During the two years that have intervened, the demand for this product has taxed the capacity of this company. The high quality of "Doehler Process" aluminum die-castings is best demonstrated by the fact that the spark levers, throttle levers, spork and throttle sectors and steering gears on 75 per cent of the higher priced motor cars are made by this process.

"DO-DI" BRASS AND BRONZE DIE-CASTINGS.

The Doehler Die-Casting Company now announces the evolution of a new process for die-casting brass and bronze from the experimental to the commercial stage. During the past year this company has been delivering brass and bronze die-castings to some customers, although the product had not been advertised. Samples of these parts will be shown at the coming automobile shows to be held in New York and Chicago. This new Doehler product will be known under the trade name of "Do-Di" castings.

The process is not limited to any particular alloy; in fact, samples of yellow brass, red brass, phosphor bronze, aluminum bronze and manganese bronze will be shown.

The most striking and remarkable characteristic of this new Doehler product is that the castings are absolutely solid and free from air holes of any kind.

[The first mention of brass die-castings was made in The Metal Industry January, 1909, and the castings then shown were made by the Doehler Company, and were very fine examples of their kind.—Ed.]

CONTINUOUS PROCESS CLEANING AND PLATING MACHINE

Some years ago, Mr. David F. Broderick, the well known efficiency engineer, in the course of his investigations at a large builder's hardware plant, brought to light a fact which, while recognized, had never before been so clearly established, namely, that the cost of the plating process on small metal goods was in many cases far greater than the entire labor and material cost of the goods themselves.

This fact definitely determined, Mr. Broderick undertook the development of a means for reducing the cost and time required for plating. After much experimentation and investigation, a machine was devised which not only performed the actual plating process automatically, but which in addition cleaned rinsed and dipped automatically. A machine, in short, which accomplished automatically or mechanically all the movements hitherto performed manually in the still plating process.

THE BRODERICK PLATING MACHINE, WHICH CLEANS AND PLATES CONTINUOUSLY AND AUTOMATICALLY.

The results obtained with this machine were remarkable. The plating cost was reduced 75 per cent, the plating room floor space was cut in two, and its output doubled. From the first machine as a model, other were built until there are now a total of eighteen in operation in the finishing plants of the Yale & Towne Mfg. Company, Corbin Cabinet Lock Company, Russel & Irwin Mfg. Company, and others, each saving from $50 to $75 per day, as compared to the cost of still tank plating, and increased the capacity of the plating rooms from 100 per cent to 300 per cent. These machines, having proven their efficiency and reliability by daily operation over a period of years, attracted the attention of the Munning-Loeb Company, of Matawan, N. J., who after a careful investigation purchased the patent rights from Mr. Broderick.

The machine illustrated herewith consists of a series of tanks containing the cleaners, rinses, dips and plating solutions arranged in the form of an oval, about 50 ft. in length. Above the tanks is a carrier system consisting of two endless chains driven through sprockets from a ½ hp. motor, and carrying a series of vertical rods from which the work is hung. By an ingeniously simple cam mechanism, each rod is moved forward, raised or lowered at any predetermined points, thereby passing the work through the different baths, raising it over the dividing walls between adjacent tanks and lowering it into the baths in the proper sequence of operation, finally delivering the work to the starting point completely plated.

Obviously, the movement of work provides agitation of the plating bath which permits far greater current densities without danger of burning than are possible in still tank plating, and to this fact, together with the elimination of handling, is due the economy of time which the machine provides for.

In addition to the rapidity of the plating process, it is claimed that a greater uniformity of deposit may be obtained with the Broderick machine because the time of immersion in the various baths is definitely fixed by the speed of the machine. This speed is adjusted only by the plating foreman and set by him to give the best results. The personal equation is entirely eliminated.

The machine, while thoroughly standardized in its component parts, is highly flexible as a whole and can be modified to meet any unusual requirements merely by varying the number of standard units in its assembly and the arrangement of tanks and lifting cams. The speed is adjustable over a ratio of as high as 3 to 1, and this variation may be widened if the conditions so require. For ordinary plating conditions it is found that a speed of about 2 ft. per minute is satisfactory. At this speed the work completes the circuit of the tanks in about one hour, this time sufficing for all cleaning baths, rinses and dips in addition to the actual plating. Where light deposits are desired, the speed may be increased and the time correspondingly reduced, while exceptionally heavy deposits are obtained by a slower speed and a greater time in the baths.

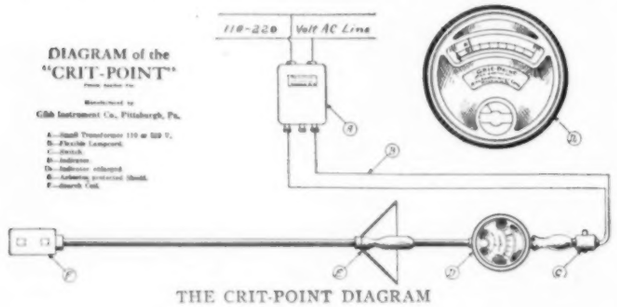
The application of the machine in any plating plant is recognized as an individual engineering problem and a suitable arrangement is offered after thorough investigation of the conditions.

The Munning-Loeb Company has acquired full rights under the patents covering this machine and are offering it for the first time to the trade.

THE "CRIT-POINT"

The critical point in the heat treatment of steel is, as its name implies, all important. The temperature at which this critical point is reached in each steel is determined in the laboratory by the aid of elaborate apparatus. The critical point of a steel having been determined, and in practical application, the furnace temperature is raised somewhat above this point and the steel is put in and is brought up to what is supposed to be the temperature of its critical point.

Many factors have to be taken into account in this method. First, unwarranted credence has to be placed in the permanent accuracy of the pyrometer, regardless of the natural deterioration of the thermo-elements which are subjected to the temperature. Second, the element of time has to be borne in mind in that a period has to elapse in order that the steel may assume



THE CRIT-POINT DIAGRAM

its critical temperature. Third, the personal factor then appears in determining whether the steel has assumed this temperature.

It is a well-known fact that steel in the process of heating loses its magnetic properties when it is brought to its critical point. The "Crit-Point," a device manufactured by the Gibb Instrument Company, Pittsburgh, Pa., takes advantage of this infallible phenomenon. Through the medium of magnetic coils, contact is made with the steel in the furnace. A magnetic indicator is placed in the circuit, which meter immediately indicates whether the steel has reached its critical point. The surface of the steel in time becomes non-magnetic, or, in other words, up to the critical point. This is indicated on the meter by an approach of the needle toward the red line, indicative of the critical point. As the heat penetrates the steel, and the interior is brought to the critical point, the needle on the indicator continues to approach the mark "Critical Point."

The "Crit-Point" does not measure temperature. When the critical point is indicated on the meter, no indication is given of what the temperature might be. The knowledge of this temperature is irrelevant; the steel is at or above the critical point.

It is obvious that most of the ills due to imperfect heat treatment are overcome by an absolute knowledge that the steel has reached its critical point.

By the aid of the "Crit-Point" the most inexperienced is made a finished heat-treating man. All the factors which have to be taken into account in the past are eliminated and first-hand information is obtained of the presence of the critical point.

THE VAPORSPRAY

By Conrad Budke, Jr.

An air-brush of remarkable simplicity and wearing qualities is the latest invention of Mr. W. C. Carter, president of the Vapor Valve Company, of St. Louis. Mr. Carter is known for many other inventions, among them a successful carburetor and a vacuum fuel feed system for motor cars. He uses a large

THE VAPORSPRAY

number of air brushes in his St. Louis plant, and for some time experienced much trouble with implements too complicated and delicate to wear long or keep in working order. Dissatisfaction with this state of affairs led him to turn his attention to the problem, and the result is the Vaporspray, which he uses exclusively in his factory.

The Vaporspray is a simple device, comprising a handle and controlling valve, with nozzle and air tube, attached to the top of a glass receptacle which contains the liquid to be sprayed. The Vaporspray operates at any pressure and is entirely controlled by a thumb-button. By reference to the accompanying drawing and the following description, the action of the Vaporspray may be understood.

The air enters at C, pressure being exerted on valve B, holding closed valve D. Valve B, being larger than valve D, overpowers same and cuts off pressure when not in use. By pressing on the button A, assisting the pressure against valve D allows the air to follow through, out at nozzle E, causing a syphon action which draws the fluid up, out of the tube F and sprays a very fine or large spray, according to the pressure exerted on button A.

The nozzle ring E serves the purpose of center alignment as well as unclogging any dried particles which may have formed when the spray is not in use. This self-cleansing feature is operated by pressing the finger against this ring and shoving it back over the shoulder on the inner nozzle which cuts all dried particles from the inside of ring E. Then when the pressure is put on button A, the air pressure forces ring E back to its place, cleaned and ready for use.

The first Vaporspray made has been in use eighteen months, and Mr. Carter states that it operates as well today as when new, without showing the slightest wear. The instrument is light and will not tire the workman using it. It is suitable for any job where an air-brush may be used, and sells complete with six feet of high-pressure air hose for $16.50.

MENACE TO HONEST GOLDS AND SOLDERS

By H. C. Ney, President The J. M. Ney Company, Hartford, Conn.

Many old idolatries have passed away. The few shrines that remain point more conspicuously to the defeat of indefensible wrongs than the many which have vanished in ruins. A better day has dawned. Practices which have long held sway and been winked at, are today viewed with such strong disfavor that those who indulge in them dare not come into the open. The press has been a potent factor in sterilizing former plague spots. No longer does the counting-room dominate the average editor. He dare utter his innermost convictions without being menaced by a request for his resignation. The fact that some venal publications remain is of comparatively trifling importance when contrasted with the great improvement during the past decade in the majority of papers published. In the technical field this purification has been even more marked.

For many years utterly irresponsible advertisers could buy unlimited space in some of the trade papers, especially "for cash in advance." It did not seem to trouble publishers that the copy used was fraudulent or near-fraudulent. They needed money for their paper, and payrolls and printing bills—so they swallowed the gilded bait. If anyone has forgotten this, a perusal of the records of the post-office inspectors, in New York City alone, will be refreshing. They show that the worst offenders were the so-called "religious" papers. A too credulous public assumed that any advertisement contained in their denominational weekly must be truthful. Literally millions of dollars were lost by the confiding readers. Occasionally publishers' endorsements appeared, the way having been paved by cash or stock donations, for services to be rendered to the advertisers.

Today, he would be a rash trade journal publisher who would allow anything to appear which bore the ear-marks of fraud. But nothing was done to protect the public until an agricultural paper published on its title page, over twenty years ago, "Rogues shall not ply their trade at the expense of our subscribers, who are our friends. Medical advertisements positively refused." For several years denunciation of so-called "mail-order frauds" enabled many undesirable crooks in various trades, under its cover, to escape undesirable notoriety. They were immune because the public was too much concerned about larger houses. But indiscriminate and unfounded allegations have gone too far.

Recently *The Grocery World* published an article by a correspondent in Sioux City, Ia., who is said to be "on the warpath" against what he stigmatizes as the "misrepresentations of the mail-order houses in their catalogs." He filed data with the Post Office Department accusing Chicago concerns with highest credit ratings. He wrote, "I maintain if the catalog houses were compelled to give the value they claim to give, within six months' time they would be bankrupt," and added, "Every mail-order catalog is full of similar misrepresentations." This is a libel upon at least one concern—not in Chicago—known widely to be transparently honest in all of its dealings. The accuser wonders why he "has not been noticed by the postal authorities"! It is such unfounded diatribes that injure greatly the business community. Those foolish enough to accept as true unsupported statements become obsessed with the heresy that all business houses are crooked.

Chicago mail-order houses alone employ at least 100,000 men and women. Shall one man's misstatements smirch the fair name of these honest workers, small though their wage may be? The company of which I am president is not interested in mail-order houses and has no dealings with any. But we are tremendously interested in having misstatements stopped and the whole truth disseminated. If untruths be allowed to hold sway, the entire business fabric will be endangered. But mail-order houses are not the only victims of envy, covetousness and malice. Honest manufacturers of golds and solders are attacked fully as fiercely. Misstatements are deliberately circulated against them, not openly, but by those in hiding and when no witnesses are present. Mountebanks have flourished for many years, despite the efforts of societies which aim to suppress them by legal procedure.

This is not new. Yet, while railroads and great corporations have "mended their ways" and now treat stockholders fairly, and publish understandable annual reports, there has been no moral improvement among sappers and miners in the gold and solder line. These men still try to get business by attempts to injure the business of others, some of which were established long before their birth. The new Campanile in Venice was built from the bricks of the original, which stood in Galileo's days, but at last toppled over, undermined by the elements. And in view of the world's progress in business righteousness, it is certain that modern business cannot be built that way. Its foundations must be cemented with skilled service, and its keystone must be spotless integrity.

Do you ask how posers can flourish while honest manufacturers can net only a small margin? I answer, They can and will flourish so long as dealers patronize them. If dentists and manufacturing jewelers and repairers would refuse to use their products, dealers could not afford to patronize them. Why will users of golds and solders accept worthless or near-worthless articles when they can buy honest brands which will make their work easier, shorter and better for the same price? Those who use meretricious wares may be able to explain, but it is beyond me. Perhaps it is for the same inscrutable reason that on a July day, when eight deaths and many prostrations from heat were reported, we saw a woman in a diaphanous dress and cobweb hose cross the avenue, carrying a fur muff and wearing a fur boa, while perspiration was running down her face.

Dentists, and others who flirt with golds and solders, whose fathers are ashamed to admit paternity, are doing their clientele and themselves permanent injury, whether they know it or not. But those men of vision who demand quality first, are continuously improving their financial and professional or business status. Quality first, stands for security and permanence for their skill, no matter in what form it is expressed.

It came to our knowledge recently that a dealer in a large city receives many orders for our golds and solders. He knows that none better can be had, and we believe he knows that ours are the world's best. He cannot make such large profits on ours as on the other kinds. Therefore he fills orders with a nameless brand and allows the dentist-consumer to think that he is getting genuine Ney's. Is this not a flagrant case? The difficulty is that the evidence which would be needed in a law court is almost impossible to procure.

Another dealer, located in the Far West, receives orders for Ney's Golds, which, we were informed, he fills by sending a lower karat than was ordered. He is careful to keep within the law, and therefore does not mark any karat on the containers or his invoices. He pockets the difference between the lower karat and the karat ordered, but is immune to prosecution because of the absence of karat marks. If charged with misrepresentation, he has only to retort, I did not misrepresent anything! I sent and billed Ney's Golds and said nothing about karats.

As Ney's always contains full gold content, and as our solder intended for a certain karat of plate is not impoverished—as are unworthy brands—the deception may go undetected. But it exists and is sure to injure us. Nor can we prevent him from buying Ney's Golds. There is always some open door through which he can get supplies. He knows that as far as mere accounting goes, a profit can be made by buying our solder for 18 karat plate and delivering it on orders for 22 karat. It is far easier to point out such abuses than to find their remedy. Thoughtful users will realize that any golds or solders, regardless of how labeled, which are offered below prices current for the "best," must be bled of their precious metal. Why pay the gold price for adulterants when you can get, at the same price, the full content of precious metal to which the price entitles you? As great an authority as John Wanamaker found it necessary to print over his signature: "There is never any room in these big buildings for the dregs of undesirable merchandise. No dishonorable, compromising of principles and fixed policies of business here."

Referring to several unscrupulous department store proprietors, he added: "Such stores are a disadvantage to the public, as proven in more than half a dozen notable instances.

The education of our people is to glorify life by honor, truth, integrity, and not to degrade life by false markings, false words and anything that deceives another or the public."

Consumers of golds and solders, whether in the dental supplies trade, and dental profession, or in the manufacturing jewelry and repair line, can profit richly by the wise counsel of Adam Smith in his "Wealth of Nations." Published in 1776, his words are adapted strikingly to today's activities. He wrote: "Before the institution of coined money, however, unless they went through difficult and tedious operation, people must always have been liable to the grossest frauds and impositions, and instead of a pound weight of pure silver, or pure copper, might receive in exchange for their goods an adulterated composition of the coarsest and cheapest materials, which had, however, in their outward appearance been made to resemble those metals. To prevent such abuses it has been found necessary, in all countries that have made any considerable advances toward improvements, to affix a public stamp upon certain quantities of such particular metals."

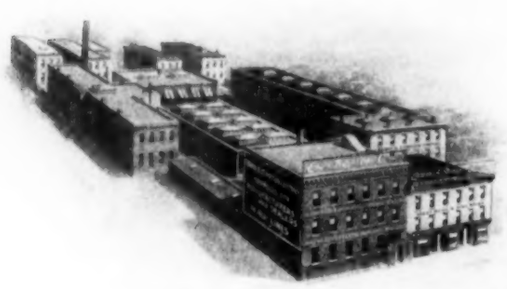
It is not only the value of the content of precious metal that governs prices of golds and solders. Labor is a big factor. It would be most illogical for anyone to assert that the highly specialized skill which fashions our products is worth no more than the raw, careless labor and lack of skill used in unworthy brands. Adam Smith wrote under Real and Nominal Price: "Labor is alone the ultimate and real standard by which the value of all commodities can at all times and places be estimated and compared." At great length he shows the difference in value between skilled and unskilled labor. Why does a suit made by a Fifth avenue, New York, tailor cost three times the price of one made from the same or similar cloth by a Chicago mail order tailoring concern? Because the first is hand-worked by artists, fits perfectly, always keeps its shape, and can be worn several seasons. You know what the limitations of the ready-made suit are.

Our golds and solders are sold at no higher eventual prices than those intended to deceive the very elect command. This article is not intended to exploit the merits of Ney's products. Our concern pays for large space for that purpose. But I want this publicity to be an eye-opener to many men who should know—but do not—the menace to their welfare that poor golds and solders are. I want to make clear that we can not always restrain unscrupulous persons from buying Ney's and palming them off as being of higher karat than they really are. You will be safe in buying of a dealer established long enough to be noted for honorable dealings. You should refuse to accept anything which reaches you in any but Ney's containers, and the containers should be intact. Signs of their having been opened are fair indications that there has been tampering with the original contents, and such containers should be refused.

If you are not sure that your dealer will supply genuine Ney's you should order direct from us. After filling your first order, we will refer you to a responsible dealer upon whom you may depend safely for supplies. The time is coming when the rank and file will be purged of such concerns and practices as John Wanamaker and Adam Smith referred to, and absolutely fair dealings will be the order of the day. "Caveat emptor" ("let the buyer beware") will then no longer be heard.

EDWIN B. STIMPSON COMPANY

A glance at the growth of the Edwin B. Stimpson Company from a small beginning to the present plant, large, complete and up-to-date, as shown in the picture, is ample evidence of the fact that the business is conducted on sound and progressive principles, and that here is made a high-grade product that has won the confidence of its consumers. This plant is located in Brooklyn, N. Y., and in it are made an immense variety of wire and sheet metal supplies in brass, copper, etc., used by manufacturers and dealers in many lines. They carry a very large stock of rivets, eyelets, grommets and washers. Orders for the ordinary line of goods can be shipped within a few days after the orders are placed. In addition the company makes many automatic machines for inserting and attaching the various articles that it makes. A large supply of all its products is kept constantly on hand, thus insuring prompt deliveries.



PLANT OF THE EDW. B. STIMPSON CO., BROOKLYN, N. Y.

The founder, Edwin B. Stimpson, now deceased, was born in Northampton, England, and migrated to America in 1852. Two years later he went into business for himself near Franklin Square, New York. Twelve years afterward he moved into larger quarters at 100 Gold street, and in 1873 the rapid growth of business made another change necessary, this time to 31 Spruce street. In 1883 Edwin B. Stimpson, Jr., was admitted to partnership, and five years after that time the senior partner and founder died, the business being continued by the son. The Brooklyn factory was erected in 1904 and all manufacturing transferred there, while the 31 Spruce street building continued to be utilized as office, sales and stock rooms.

The business was incorporated on July 15, 1907, under New York State laws as Edwin B. Stimpson Company. The officers are as follows: Edwin B. Stimpson, president; Henry V. Rau, vice-president and treasurer; William F. Kobilak, assistant treasurer, and Henry W. Doehrer, secretary. The building on 70 Franklin avenue, Brooklyn, adjacent to the factory, was erected in 1910, and used as principal office and salesrooms. The New York office was discontinued altogether about one year later, and now the company is wholly situated at Brooklyn.

The various buildings shown in the illustration have, from time to time, been added to the plant, and, judging from the history of the concern, it is a safe guess that the coming years will witness an even greater expansion.

RILLTON BRASS CLEANER

The S. Obermayer Company, manufacturers and dealers in foundry supplies, Pittsburgh, Pa., has recently put upon the market the Rillton brass cleaner. This cleaner is claimed by the company to be not a flux, but a reducing agent, and it is said that one pound of the cleaner placed in the bottom of a ladle holding five hundred pounds of molten metal will keep the ladle absolutely clean of scum and reduce all oxides to metals. It is stated that dross that, before the use of the cleaner, contained 10 to 25 per cent. of oxide will contain, after use, only ½ of 1 per cent. The manufacturers state that the molten metal contains no oxides, the castings are more solid and will stand hydraulic or air pressure tests. The Rillton brass cleaner (patented) sells for 3 cents per pound and will be sent upon approval to prove the assertions of the Obermayer company.

"NASITRA" MARKING FLUID

The Artisan Chemical Supply Company, Box 395, Detroit, Mich., is now manufacturing a fluid compound known as "Nasitra," for use in marking metal products. "Nasitra" is especially adapted for marking products made of those grades of steel commonly used in the manufacture of tape measures, gauges, scales, etc. It is used without requiring the metal to be first coated with paraffin, wax or soap, the only requirement being that the surface of the metal to be marked must be perfectly clean. Then the fluid is applied with a pen or sharpened piece of wood. Manufacturers who have a large number of carbon or high-speed steel products to mark should find this compound very useful.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

NATIONAL ASSOCIATION OF BRASS MANUFACTURERS.

The 30th annual meeting of the National Association of Brass Manufacturers closed with a banquet at the Hotel Astor, New York, on Friday evening, December 14. A vote of thanks was given to the banquet committee for its labors and effort, which contributed so materially to the success of the affair. The committee consisted of: A. S. Hills, Haydenville Company, Haydenville, Mass.; C. C. Hale, Peck Brothers & Co., New Haven, Conn., and C. H. Downs, E. Stebbins Manufacturing Company, Springfield, Mass. An address on "Salesmanship" was delivered by Professor L. S. Wright, and some pleasant reminiscences and humorous remarks were presented by the genial Francis J. Torrence, of Pittsburgh.

During the session of the meeting many matters were discussed, principal among which was the adoption of an order that after the first of January we will totally eliminate the jewel cup tube from hose connection on bath cocks, and otherwise make bath cocks of a uniform standard as to size and threads so that all parts still interchange. It was decided to prepare a cut of a bath cock showing totaled measurements, threads and the external appearance of the cock as it will be supplied in fuller, compression and quick opening work after January 1, 1917.

A committee was appointed for the purpose of developing other matters of importance, which committee consisted of: E. F. Nedecken, chairman, Hoffman & Billings Manufacturing Company, Milwaukee, Wis.; M. J. Koblitz, J. A. Cochrane Bross Manufacturing Company, Cleveland, O.; C. S. Johnson, Northern Brass Manufacturing Company, Waukegan, Ill., and A. I. Fischer, Glauber Brass Manufacturing Company, Cleveland, O.

A committee to outline a uniform cost system for obtaining costs on various lines of goods was appointed, and consists of: Adolph Mueller, H. Mueller Manufacturing Company, Decatur, Ill.; G. C. Hall, McRae & Roberts Company, Detroit, Mich., and H. N. Gillette, Standard Sanitary Manufacturing Company, Pittsburgh, Pa.

A uniform acceptance order blank was adopted and will be put in use, making all orders of any magnitude a contract, and not subject to cancellation. A notice was ordered prepared and sent to the trade bearing on this subject. The association ordered a seal or emblem be gotten out for the use of members on all their printed matter.

The association became affiliated with the Chamber of Commerce of the United States of America, and appointed Mr. Adolph Mueller, of the H. Mueller Manufacturing Company, Decatur, Ill., councillor, and Mr. C. C. Hale, of Peck Brothers & Co., New Haven, Conn., his alternate.

It being the annual meeting the following officers were elected: President, C. H. Downs, E. Stebbins Manufacturing Company, Springfield, Mass.; first vice-president, Harold W. Wolff, L. Wolff Manufacturing Company, Chicago, Ill.; second vice-president, E. Rickersburg, Rickersburg Brass Company, Cleveland, O.; trustees, L. D. Lawnin, Edwardsville Brass Company, Edwardsville, Ill.; H. N. Speakman, Speakman Supply & Pipe Company, Wilmington, Del.; W. H. Wasweyler, Milwaukee Brass Manufacturing Company, Milwaukee, Wis.; A. I. Fischer, Glauber Brass Manufacturing Company, Cleveland, O.; H. N. Gillette, Standard Sanitary Manufacturing Company, Pittsburgh, Pa.; Adolph Mueller, H. Mueller Manufacturing Company, Decatur, Ill., and Wm. M. Webster, Chicago, commissioner. Representatives to the national committee are: A. S. Hills, eastern representative; H. N. Gillette, western representative.

The impression prevailed that irrespective of the termination of hostilities on "the other side," there would be a brisk demand for goods for months to come, and that copper and other metals are holding their own, and in some respects advancing. A poll indicated that all were operating full handed with plenty to do for 60 to 90 days; others for a longer period, and, generally speaking, business conditions were found good, with the demand for materials strong.

After a three days' session the meeting adjourned to meet in Chicago, Ill., March 21 and 22, 1917.

AMERICAN INSTITUTE OF METALS

Secretary Corse reports; "That the Institute of Metals has shown a very gratifying increase in membership during the current year, indicating that the members receive full value for the dues. Our latest Volume of Transactions is an improvement over our others on account of the use of a better quality of cuts and the increased number of them, while the character of the papers included in this volume, and also those for Volume 10, reflect again the very good work done by the papers' committee.

"The discussions at the last annual meeting were unusually good, and were participated in by many who had never attended our meeting before. The work of the advisory committee, possibly better described as a consulting committee, of the Bureau of Standards at Washington, has been very valuable; two meetings have been held at the bureau, both well attended, and the results would seem to be very satisfactory.

"We are glad to be able to state that we number among our membership some of the best metallurgical minds in the country, of course, with particular reference to non-ferrous metals. As our institute grows it is becoming increasingly evident it has a very distinct place to fill in the technical world. We especially urge anyone who is interested in the subject of non-ferrous metals in any of its phases to communicate with the secretary regarding membership."

AMERICAN ELECTRO-PLATERS SOCIETY

Walter Fraine, secretary-treasurer of the American Electro-Platers' Society, has written the following about the activities of the society in 1916 and its aims for 1917:

"The past year has been a successful and prosperous one for the American Electro-Platers' Society. Business conditions throughout the United States and Canada have been so good that the loss in membership, which slowed up the growth of the society during 1915, has been entirely absent during the past year. Each branch society in existence a year ago shows a substantial increase in membership. Two new branches have been organized during the year, one in Providence, R. I., in March, and one in Syracuse, N. Y., in August, 1916, the Providence branch since its organization having nearly trebled its membership to date. A total increase for the society of nearly 20 per cent is had for the year. The finances of the supreme society and the branches are in satisfactory condition.

"As a result of action taken at the Cleveland convention an education bureau has been organized recently to initiate educational work for the entire society, in addition to the educational programs of the individual branches. We believe this bureau will become a considerable factor in increasing the usefulness of the society to all concerned. The members of the bureau are Messrs. George B. Hogaboom, New Britain, Conn., chairman; E. W. Heil, Wichita, Kan., and Wm. Voss, New York, N. Y. A number of prominent chemists and electro-chemists have been invited to serve as advisory members.

"Reports from President Williams and the St. Louis branch have been received, stating that plans are already under way for making the 1917 convention the most successful of any yet held. The manufacturers of St. Louis have promised their co-operation in making the local exhibit especially good, and numerous applications have already been received for space from

supply houses to the trade. An exceptional educational program is also promised.

"The year 1917 has every promise of being the most prosperous and successful year of our existence."

New York Branch—William Fischer, 300 St. Ann's avenue, New York, N. Y., secretary.

The members of this branch are organizing a class in chemistry for the benefit of the members, who wish to learn all they can about the chemicals used in every-day practice. They are also working to make the annual banquet of this branch, which will be held at the Broadway Central hotel, Broadway and Fourth street, New York City, on February 17, 1917, a success.

Newark Branch—Edward W. T. Faint, president, and George Reuter, Jr., 333 South 9th street, Newark, N. J., secretary.

This branch held a special open meeting on December 15, at which time Dr. H. B. North, professor of chemistry of Rutgers College, New Brunswick, N. J., gave an address on "Chemistry for the Beater," after which Edward W. T. Faint, president of this branch, gave a short address on the history of the organization, followed by short speeches given by H. Bernard and R. E. Massicotte, of the New York branch.

Among the questions asked was, what was a sure method of eliminating hydrogen bubbles from the nickel deposit?

General conclusions: I, keep the solution well balanced, neither acid nor alkaline; II, keep the metal content up to the standard, also the amount of conducting salts; III, not neglecting any of the above and also agitating the cathode rod either by a current of air or suitable mechanical means, and the nickel deposit would be free from occluded hydrogen.

The meeting was one of the most helpful held for a long time.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

Carl Dittmar, for many years connected with the sales department of the New York office of the Roessler & Hasslacher Chemical Company, New York, N. Y., and lately manager of the Trisalyt department, has been appointed resident manager for the company in Cincinnati, Ohio.

Andrew M. Fairlie has accepted an appointment to the position of chemical engineer with the newly-organized Tennessee Copper and Chemical Corporation, whose works are located at Copper hill, Tenn. Mr. Fairlie is known to many of our readers as the first secretary of the American Institute of Metals, formerly known as the American Brass Founders' Association.

Walter S. Barrows, a past president of the American Electroplaters Society, and for the past twenty-one years foreman electro-plater with the Canada Cycle and Motor Company, Toronto, Ontario, has resigned his position and will devote his entire time for the next year to experimental electro-plating with cobalt and electro-chemical researches. Mr. Barrows has recently equipped a laboratory in Toronto for this particular work, and all investigations will be made upon a commercial scale and under conditions easily duplicated in an industrial plant.

DEATHS

ALFRED A. COWLES

Alfred A. Cowles, president and treasurer of the Ansonia Clock Company, one of the largest manufacturers of time-pieces in the United States, died on December 8, 1916, at the Apthorp apartments.

A. A. COWLES

Mr. Cowles was born in Torrington, Conn., and received much of his education in Paris. He came to New York when he was a young man and entered the employ of the Ansonia Clock Company, with which his father, George P. Cowles, was connected. He also became financially interested in the Ansonia Brass and Copper Company, which he later merged with other companies under the name of the American Brass Company, of which he was vice-president at the time of his death. Mr. Cowles was a member of the Union League Club and of the Golf and Country Club in Greenwich, Conn., where he had a summer home. Surviving him are two sons, Frederick H. and Russel A. The latter is president of the Metals Trading Corporation, New York.

GEORGE A. MORRISON

George Austin Morrison, treasurer of the Metals Trading Corporation, New York, N. Y., as mentioned in THE METAL INDUSTRY for December, 1916, died suddenly November 29 of heart disease. Mr. Morrison was a lawyer by profession, but was interested in several corporations, including the United Zinc and Smelting Corporations and the Metals Trading Corporation. He was the author of a number of works on genealogy and history and was a member of many prominent historical societies.

G. A. MORRISON

Mr. Morrison was the son of George Austin Morrison and Lucy Ann (King), and was born in New York City, March 26, 1864. Entering Harvard, he graduated in 1887, and later graduated from the School of Political Science in 1888, and from the Columbia University law school in 1889. He was admitted to the Bar of New York City in 1889, and practiced law as a member of the firm of Morrison and Morrison, and latterly under his own name. He is survived by his wife.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

JANUARY 8, 1917.

There was never a more prosperous, more growing, more satisfactory year in the brass and copper industries of the Naugatuck valley, which are centered here, than the year 1916. In every industry the full speeds of machinery and men were taxed most of the year. Great new buildings which had been rushed to completion since 1914 were equipped with the most modern improved machinery, manned with labor of every grade, and almost every race and color, and kept humming night and day throughout the entire period. Unknown-of rates were set in dividend paying and stockholders found that stocks which they had held for years, some of them somewhat reluctantly, were worth more than their weight in gold many times over. Production was at the maximum in the history of all industries, efficiency was high, management was surprisingly capable and altogether the corporations and individuals may be truthfully said to have outdone their own best estimates of their strength and capability.

As a consequence this little center of the country stands out pre-eminently before the industrial world as markedly efficient despite the numerous natural disadvantages under which it works, and there is no doubt that the eyes of the investment world were opened to that fact, even with all the competition that is visible in all parts of the country. No one can hereafter say that this part of the United States of America is unprepared at least for industrial stress, for it has met and passed a most exacting test and is going serenely forward, confidently and successfully, while some others, blinded by their prospects and misled into financial or industrial eel grass, so to speak, have had to halt, call consultations, plead with expert financiers and practically admit failure in management with every opportunity for success all around them.

Some figures speak louder than words. The Scovill Manufacturing Company, which makes parts of munitions, parts of shells for several of the Entente Allies, and an endless variety of domestic products, has $5,000,000 capital. On that it paid dividends, regular and extra, amounting to 128 per cent during the year 1916. Its regular dividend averaged eight per cent for several years. In addition it declared and paid ten per cent extra dividends twelve times—once a month—throughout the year. The total thus paid out to stockholders was $6,400,000.

The American Brass Company, whose capital is $15,000,000, paid 25 per cent in dividends during the year, the extra dividend being six per cent. The total thus paid out to stockholders was $3,750,000.

The Plume & Atwood Manufacturing Company, comparatively small besides these corporations, paid eight per cent on its capital of $1,250,000, or $100,000.

Even the Seth Thomas Clock Company of Thomaston, which is one of the concerns not especially benefited by the war and which has been through a trying period of reorganization and plant rehabilitation, paid six per cent preferred in 1916.

These illustrate the trend of the profits in various lines. The story is too long and the figures too confusing to warrant detailed report. There were dividends for practically every corporation hereabouts this year and in addition there were generous bonuses to the employes.

In the Scovill plant bonuses were declared more frequently than in any other, perhaps, but the employes seem to be well pleased in all plants, satisfied that the rewards for labor have been fairly divided up, as between plants. Christmas bonuses ran from sums under $25 to sums in the thousands. Probably hundreds of Waterbury factory hands counted bonus money received over and above wages and overtime pay amounting to about $500 during the year, and scores of individuals in some shops received as much as $500 in their Christmas bonuses alone.

All the time there has been no cessation in the building projects and great new plants continue to take their places on newly graded sites which Waterburyans two years ago doubted would ever be wanted for factory purposes. The great works of the Scovill Company stretched out more and became more compact at the same time, the smaller buildings and sheds and tracks and storehouses rising overnight, as it were, on the spots vacated by the building contractors as the larger units were completed and turned over to the corporation for equipment. Not alone to this plant does this apply, but equally to the American Brass properties and the Chase Metal Works, Waterbury Manufacturing Company, Plume & Atwood Manufacturing Company, Waterbury Clock Company, and scores of smaller concerns. Building tradesmen have been as much in demand as metal workers and no class of labor can claim to have found the market heartless here.

Up in Waterville there is daily a wonderful changing panorama, due to the tremendous speed of development at the plants of the Chase Metal Works. These great new buildings, the first of which was just completed before the war broke out and was a wonder for size and equipment, continue to expand and are rapidly growing into Thomaston, showing that the extensive plans to acquire land along the banks of the Naugatuck a few years ago were very wise, though laymen wondered why anyone should want so much if it were not to keep objectionable competitors away. The question now is only whether there is land enough. At night this dark dreary section suggested nothing in the form of great industrial development two years ago, only one great plant appearing to be in operation; today the great new glass and steel structures blaze gloriously, and effectively point the way of Waterbury's development up the river. It is not hard now to picture one great brass city, a decade or two hence, stretching from Ansonia to Winsted and almost completely masking the humble Naugatuck river.

With all this prosperity and tremendous business demanding all their energies, the Waterbury manufacturers have shown themselves able and competent to embark on new fields. Social service is thriving today within the factory more than without, if that is possible. The manufacturer has come to regard the welfare of the employe as extremely important to him and his welfare. The manufacturers are spending money to improve the conditions of their plants so as to conserve the health of their workers, and to improve the living conditions outside so as to conserve the health and happiness of the families dependent on the wages they pay.

One notable instance of this is the housing campaign undertaken by the three largest manufacturing concerns, the Scovill, American Brass and Chase corporations. John Nolen of Cambridge made a survey, recommended certain plans and withdrew. The manufacturers considered, adopted plans and began to build. The greatest housing plans ever undertaken in this country by manufacturers for the benefit of their employes and their families are now in progress here today. Some of the model homes are completed and occupied; others are being finished rapidly and before this year ends thousands will have found shelter in these houses and Waterbury will have added hundreds of new homes to its grand list. A film corporation which has been making pictures of the building operations and chambers of commerce throughout the country will have opportunity to witness the pictures. This announcement has just been authorized by the W. G. Lynch Realty Company, which is in charge of the work.

One more bit of evidence of the spirit here is the success of the six-day campaign of the Y. M. C. A. of Waterbury to raise a building fund of $350,000. There were some subscriptions of from $25,000 down to $100 from corporations, one of $30,000 from the Misses Kingsbury, daughters of the late Hon. F. J. Kingsbury, and the rest were from dimes to $5,000. The sum

and several hundred dollars over were subscribed within the six days, setting a new world's record, according to International Y. M. C. A. Secretary C. S. Ward.

There are enough other similar undertakings here to make a good-sized book, briefly described.

There has been no milk and honey in the running of affairs, else the efficiency of the local talent in brass-making would not have been so well tested. It has been a year of difficulties of most aggravating nature. Coal and raw materials are in great demand and freight service is considerably hampered. There were serious difficulties over embargoes early in the year and the traffic departments found themselves put to new tricks to help along the New Haven road and keep their plants going. Money has been spent freely to get materials and fuel to plants in order to prevent a shutdown at critical moments, and sincere prayers of thanksgiving have been offered thus far this winter for the open weather and the slight improvements noted in railroad service.

One result of this is the undertaking of the American Brass Company to build a great new freight depot for its own plants at Devon, the point being favorably placed to receive freight either by rail or water. Another is the undercurrent of talk among business men and manufacturers as to the advisability of starting a new railroad to supply the transportation needs of this section.

Labor unrest has not been missing, but the slight upsets that have occurred in this respect have generally been smoothed out as soon as the protestants found a safe medium through which to make known their complaints to headquarters. Conditions in this respect are peaceable now.

Where every kind and condition of labor is in demand there is constant need of supervision and readjustment. Efficiency committees are working now in the larger plants and shifting the material available that the best results may be obtained. Inventorying is going forward smoothly and on schedule, though there never was more to be done. On the whole, masters and men find themselves far better disposed to get along peaceably and effectively than either suspected in times when they were less pushed to produce the goods.

All industries are thriving, even novelties and watch-making having taken long strides forward although a bit sluggish for a few months.

Smallpox broke out in the fall in mild form and is still prevalent to a limited degree. Thousands have been vaccinated in the shops, and the disease's course seems to have been checked but there is still a problem in that respect. The inpouring of labor from all parts and crowded houses as a consequence are doubtless chiefly responsible.

Clearings in the local banks, for 1916, broke all records, passing the $10,000,000 mark for December alone, indicating a steady and strong current of receipts and disbursements in all business.

—F. B. F.

NEW BRITAIN, CONN.

JANUARY 8, 1917.

A review of the metal industry conditions as they have existed in the local manufacturing concerns during the past year shows that never before in the history of any of the factories have conditions been as good, orders as plentiful, profits as large or help as hard to secure. The waning year of 1916 has been one long to be remembered in the annals of metal manufacturing concerns here. Not only have the old and established concerns of New Britain expanded and enlarged to an appreciable extent during the past twelve months, but several new concerns have also located here and another new one will shortly begin active operations. This is the recently organized Eastern Motors Company. Showing conclusively how good the business has been in this city, records for the year show that practically every one of the larger concerns built additions to their previous plants. This includes the Stanley Works, Landers, Frary & Clark, Beaton & Cadwell, North & Judd Manufacturing Company, the B. & K. Manufacturing Company, New Britain Machine Company and the Union Manufacturing Company. Also, practically every one of these concerns during the year has either increased its capital stock, increased its dividend rate, or both. Almost every factory has also materially increased the wages of many of its skilled employes during the year. Thus at the close of 1916 it may well be said that conditions in the metal manufacturing field in New Britain are well in advance of conditions at the close of 1915. Labor has been raised to a higher scale, factories have been materially increased and business has proved excellent in almost every branch.

It is seldom that foreign competitors break in upon New Britain manufacturers to any serious degree, but at the Traut & Hine Manufacturing Company, where safety razor blades have been one of the most important products, it has been necessary to discontinue their manufacture, as the Japanese manufacturers in the Isle of Nippon can do it at a greatly reduced cost. The Traut & Hine officials find that they can purchase these blades from the Japanese concerns, pay the import duties and yet have them cost less than it would to make them in New Britain. The local concern will continue, however, its manufacture of handles and other parts of safety razors. Employes in the blade department have been transferred to other departments, so no lay-off of workmen has been made necessary by the change. At each of the local concerns it was impossible to shut down but for one day over Christmas, owing to the demand for products.

While many of the concerns throughout the country, and principally throughout Connecticut, i. e., Winchester Arms and Marlin Arms in New Haven, Scovill Manufacturing Company, Standard Screw and American Brass companies, of Waterbury, and Remington's in Bridgeport, have been depending chiefly on war orders from abroad for their wonderfully increased business, and see in peace a ruination of their trade, this does not in any sense of the word hold true of New Britain's industries. Should the new year bring with it peace in Europe, New Britain's manufacturing concerns would continue to run just as busily, state the officials of several factories, and might even experience an added boom. This is because the local factories are essentially peace plants, rather than munitions plants. Their products are things necessary for the spread of civilization, rather than the desecration of the battlefield. Europe is ravaged, and when peace comes it will have to be entirely rebuilt. Hardware of all kinds will be in great demand, and it is only reasonable to believe that it will be to New Britain that the foreign builders will look when peace comes. Thus it would appear that the outlook for 1917, come what may abroad, unless this country is drawn into the maelstrom of the great world war, cannot help but be bright.

Chief among the bright spots on the 1917 horizon is the advent of the Eastern Motors Company into the field of New Britain manufactories. This concern, capitalized at $1,000,000, plans to manufacture the Charter Oak automobile, a machine to retail at about $4,000 and which will be complete in every detail and only a limited number will be made annually. The firm has leased Corbin Brothers' old factory and will assemble the new machine here. The local concern will be directly in charge of F. A. Law, of Hartford. Mr. Law is well known throughout the East as an automobile manufacturer. He was formerly with the Pope Automobile Company and more lately has conducted the F. A. Law Machine Company in Hartford, in addition to dealing in the Naticnal automobile. Mr. Law has also been with the Overland and Columbia automobile companies. As mechanical engineer and designer, he will be assisted by Mr. Turk, of New York. The officers of the Eastern Motors Company are: W. D. Upson, Waterbury, president; S. B. Hull, Meriden, treasurer; L. S. Hubbard, Bridgeport, secretary; J. R. Hall, Meriden; W. H. Pomeroy, Stamford; F. B. Reid, Hartford, and Allen Sheldon, Hartford, directors.

Added expansion at the Landers, Frary & Clark Manufacturing Company is also anticipated. This concern, at present recognized as the largest cutlery manufacturing concern in the world, is prepared not only to make cutlery, culinary utensils, etc., but in fact almost anything that can be wished. Already its business in the electrical line is enormous and its capital stock was recently increased from four to five million dollars. The factory is buying considerable land about the city for future development and a new $30,000 factory building for the manufacture of pocket cutlery alone will soon be erected. It is also understood that this company at present has a skilled man with a concern in Pennsylvania learning the business of that company that he may possibly assist in taking charge should the local factory decide to purchase the other plant, as has been currently reported.

Government contracts for the building of submarines and

other naval supplies in Connecticut is expected to prove an additional boom for the Stanley Works rolling mills. At present these are running day and night to keep abreast of orders, and many of these are from the government. Other concerns are likewise looking forward to a bright future.—H. R. J.

PROVIDENCE, R. I.

JANUARY 8, 1917.

The year that has just closed will go down into the history of the metal trades of Rhode Island as one of the most trying for the manufacturing interests in the state, as well as in the entire country, that has ever been experienced. Business has been very brisk in practically all lines during the greater portion of the year, but it has not kept pace with the trouble that the different manufacturers have had to face.

At the beginning of the year the manufacturing plants throughout the state had so far recovered from the ill-effects of the Underwood bill, and of the commencement of the war in Europe, that most of them had reached out for and obtained considerable new business that was directly traceable to the struggle that had been raging for more than a year over seas. This was especially true of the makers of machine tools, small tools and the owners of plants that could be devoted, with comparatively little alterations, to the making of munitions.

The greatest trouble during the closing months of the year has been in connection with the labor situation. Expert, or even desirable help, has been decidedly scarce almost from the opening of the year in almost every line of industry especially among the metal working trades, and this fact, added to the increasing prices charged for common necessities of life, caused much dissatisfaction among the workers. As a result there has been a constant succession of strikes, big and little, throughout the state, as well as elsewhere in the country. Fortunately the majority of these have been of short duration, mainly because the manufacturers have not been in a position to fight them, for mill profits have ranged high, as a rule, in every line of industry in Rhode Island, the metal lines being no exception.

At the beginning of the year those factories that were in a position to accept war orders were receiving some of this business and several exceedingly large contracts were placed here, including those at the Brown & Sharpe Manufacturing Company, which consisted mainly of machinery for making small tools and also for the making of munitions and guns; the Gorham Manufacturing Company, which received large orders for three-inch shells and the Walco Company, which reopened the old American Locomotive Company's plant on Kinsley avenue to make vast quantities of fuses for three-inch and 75-centimetre guns.

The jewelry manufacturers have had their first fat year in some time, and report has it that they have taken full advantage of it. Beginning the year there was considerable optimism shown by the factory owners in this city and the Attleboros, and that this optimism was not misplaced is shown by the conditions which have governed the trade during the past six months. Many of the establishments have worked overtime for several months, and the shortage of help has been all too apparent. Factories, which a year ago were practically on the verge of bankruptcy, are now paying gratifying dividends. Many know what conditions are at present among the industries of the state, but there are very few to be found who will attempt to guess as to what they will be a month, three months or a year from now. Wages were never higher than at present, working conditions were never better, so far as can be ascertained, yet complaints of poor returns by the employes were never more numerous, or well-founded, and strikes were never so frequent. It has been said that the stage was being set for a social revolution, and many of the manufacturers are looking forward to something of the kind and are endeavoring to find a preventative therefor.

The trend of the times has been forcibly shown in the recent wage advances an dthe notices which accompanied them. These latest advances were characterized as being profit-sharing propositions by the manufacturers, and in many cases are so regarded by the operatives. This is believed to be one of the best solutions for the New England manufacturers, and one which will have to be adopted in some form, before industrial peace will be assured to the various factories located in this section.

No other part of the country has the problems of the New England section where it is necessary to import the raw material from all parts of the world and to export to all parts of the country the finished products in order to find a market for it. With these conditions prevailing, and more factories and shops springing up in other sections of the country to compete with those of Rhode Island and other parts of New England, many believe that it will be absolutely necessary to adopt some sort of profit-sharing in order to keep operatives at work and to keep the industrial peace. In the meanwhile everything is running to capacity with orders on hand sufficient to continue steady operations for an indefinite number of months.

The Eastern Bolt & Nut Company is erecting an addition to its one-story building off Massasoit avenue, East Providence, for storage purposes. The addition is to be 50 by 30 feet.

The Phillips Lead & Supply Company has been awarded the contract to supply the city of Providence with pig lead and lead pipe.

Levi J. Perkins has purchased the R. E. Sturdy electroplating business at 190 Eddy street.

The contract for the plumbing in connection with the new plant of the Providence Brass Works of the General Electric Company has been awarded to William M. Keller, 391 Elmwood avenue, this city. This is one of the largest plumbing contracts recently let in Rhode Island. The plant is being erected at an expenditure of about $500,000 and the plumbing work will figure approximately $20,000.

The Abrasive Machine Tool Company has completed its new building located just west of the plant of the Eastern Bolt & Nut Company, Massasoit avenue, East Providence. The installation of new machinery has already commenced.

Employes of the City Brass Foundry found $5 gold pieces in their envelopes the Saturday before Christmas, the money being given by Manager James J. McKenna as a bonus for the year's work.—W. H. M.

ATTLEBORO, MASS.

JANUARY 8, 1917.

The year just past has been an eventful one for the Attleboros in that it has seen this section recuperate from two years of hard times during 1914 and 1915 which started jewelry business on the wane owing to a number of existing conditions, principally the general paralysis of business throughout the country three years ago.

For two years the Attleboros struggled to overcome the calamity which seemed inevitable, but despite the most valiant efforts of the manufacturers the industrial conditions here would not warrant the growth and prosperity that might be expected.

But during the past year all these things have changed, and now there is every indication that the jewelry business has come back to stay. Manufacturers are practically unanimous in saying that the jewelry business never was better. The factories report an average increase in business of 40 per cent. over 1915, and many of the shops are working on an overtime schedule. The greatest trouble, which has been met during the past six months has been the scarcity of labor. This has been a serious menace to the advancement of the jewelry business, and is one which has been hard to relieve because of the prosperious conditions throughout the country, especially in Connecticut, where many of the Attleboro help went during the dull times here.

Financial reports show that there were only 16 failures in the Attleboros during 1916, and that the firms which failed had assets of $101,456, and liabilities of $286,264. Two of the oldest and most prominent firms in Attleboro went out of business during the year, the Mason, Howard Company and the Horton & Angell Company. Neither of these firms were in financial difficulties. The Horton & Angell plant and good will were sold at public auction, and the purchasers were Attleboro people, who, it is believed, will continue the business.

Taunton's stove foundries, silverware shops and machine shops have had a most prosperous year, and that part of the district is figuring on 1917 as another big year in its history.

With the assurance of the most conservative business men

that the past year has been one of prosperity, and that 1917 should be equally so, merchants and manufacturers of Attleboro and the surrounding towns are preparing to enter the new year with a spirit which augurs well for success.—G. S. M.

ROCHESTER, N. Y.

JANUARY 8, 1917.

Every metal industry of Rochester is unusually busy at this time, and the condition promises to continue for some time to come. The heads of the larger manufacturing plants, all of whom are heavy users of metals, admit that business was never so strong and persistent. Nearly every big institution in Rochester has booked orders nine months to a year ahead.

Business is especially good with the several stamping works, the General Railway and Signal Works in Lincoln Park, the Symington plant, and Eastman Kodak Company. The stamping companies are heavy users of copper, steel and brass. The Symington Company has two munition plants, both of which are running at full blast and employing three shifts of men. It is said that the company has contracts with France, Japan and the United States governments for steel and brass forgings, with copper attachments, that will carry the plants in continuous operation three years after the European conflict has ended.

Manufacturers here have been greatly interested in the copper situation during the past year, and the general feeling is that the crest of high prices may have been reached. Holders of sheet copper and accessories are well supplied for emergencies, thus protecting business for many months to come. However, large dealers in sheet metals, tin plate, etc., are not placing orders for future business at this time, merely falling back upon supplies on hand.

Shipping facilities out of Rochester have not been good for months. In fact manufacturers here are suffering from car shortage as in other sections of the country.

A new industry that located in Rochester in September last is the Movette Camera Corporation. This concern manufactures motion picture cameras, and promises to develop into a large concern. The plant is equipped for the employment of 600 men, about half of that number being at present engaged. The concern will use large quantities of copper, bronze, sheet steel and brass.—G. B. E.

DETROIT, MICH.

JANUARY 8, 1917.

The metal industry has closed one of the most prosperous years in its history. Since January first, business has been a constant rush, practically all plants in the city and suburbs working to full capacity. Added to this, these same plants are still engaged on contracts that will keep them busy indefinitely. At the same time all these concerns have improved their facilities and are reported to have laid aside a surplus.

The principal rush orders apparently have come from the automobile trade, although all lines have been heavy. Work on war contracts also has been extensive and still is continuing with no break, although this may show a letup to some extent when the present contracts are completed; but it is reported, however, that these are sufficient to keep the concerns busy for a long time.

Work in the automobile accessory line has been the greatest the city and suburbs has every reported. Every automobile plant in the city has increased its output and still many are planning for further increases. Most of these concerns operate their own brass, copper and aluminum plants, but the demands for accessories and parts is so heavy they are forced to obtain these supplies in great quantities from outside concerns. The result is, practically every brass, copper and aluminum plant in the city has all it can do. While working on automobile contracts many are also engaged in other lines, such as plumbers' supplies and electrical devices.

One concern in particular, the Detroit Copper and Brass Company, reports an exceedingly prosperous year, with sufficient business ahead for many months to come. The automobile industry seems to show no letup, as all the large producing concerns are flooded with orders and are planning great extensions. The Studebaker Company is one of these. It has already started the erection of a ten-story steel concrete and tile structure for use as a service station, this being the second largest of the kind in the city.

The trade has been handicapped by one annoying condition for the last three or four months—the lack of cars and inability to obtain sufficient coal. The Ford plant, which uses more than three hundred cars of coal a day, closed the last week in the year in order to relieve congested conditions in the local yards, but it resumed work January first. It is estimated that 20,000 loaded freight cars lie on sidings within ten miles of the city, a great many of which are filled with coal and gasoline. Owing to this congestion oil stations about the city are about all sold out. Many brass, copper and aluminum companies are handicapped by the lack of coal, and also cars for shipping purposes, and if present fuel conditions continue for any length of time they may have to curtail their output or close until conditions are relieved.

The Detroit Bearing and Castings Company, 75 West Baltimore avenue, reports a heavy demand for the copper and lead alloy known as "Mil-Loy" metal. It seems to meet the demands in the aeroplane industry and the marine trade, where it is found particularly useful for gears.

The Plymouth Motor Castings Company, Plymouth, Mich., is now supplying great quantities of castings for Detroit and suburban automobile plants. This concern is practically a new concern which has, within the last year, completed facilities for doing a great amount of work.—F. J. H.

The business outlook for Detroit and vicinity in the manufacture of metal goods for the past month has been very active.

Within the past four weeks the metal market has been most active and exciting, and few of the manufacturers have seen its equal in the long time they have been in business.

Detroit is a leading center for the different metals that enter into the composition of brass, owing to the large amounts that are used by the automobile trade and that used by the leading manufacturers of steam and plumbing specialties here, which are among the largest in the world.

Not only the local manufacturers, but the brass manufacturers along the Canadian border, of which there are quite a number, have placed heavy orders with the local dealers and smelters this year as their plants have been running day and night for the past year, and shipments to these concerns have been very heavy each week in the year, as high as six cars of ingot brass going to one concern every day for one week.

All the leading brass manufacturers are running to their capacity on orders, and are not manufacturing any stock at present, although their stocks of standard goods are down low at present.

Detroit is getting busy to get in on the ground floor in the building of aircraft. With the sum of $50,000,000 already appropriated by Congress for aircraft and equipment, the manufacturers see prospects of it eclipsing the marvelous growth of the automobile industry. Detroit, having automobile factories equipped with the machinery and tools that can make air plane parts, is therefore the logical center for the airplane industry, and different manufacturers are investigating and experimenting along that line.

Howard E. Coffin, president Hudson Motor Car Company, who is a member of the Naval Advisory Committee, and who is one of the leaders in industrial preparedness, is taking an active interest in this matter, and is lending his assistance to the different manufacturers, who have given the matter consideration. There has been two new concerns incorporated, and will start business at the first of the year 1917. The Lincoln Brass Works, of Detroit, has been capitalized at $15,000 to manufacture brass goods. The incorporators are E. H. Mueller, of Detroit; John O. Stephens and B. Ellison, of Highland Park, Mich.

The Chase-Prost Manufacturing Company has been incorporated, and will manufacture carbureters and other automobile brass specialties. Chas. J. Prost, W. O. Chase and F. W. Irwin are the stockholders.

The business outlook for 1917 looks very promising at the present time after one of the most phenomenal business years in the history of Detroit. At the present time all eyes are on the metal markets awaiting future developments.—P. W. B.

COLUMBUS, OHIO

JANUARY 8, 1917.

The metal market in Columbus and central Ohio has been weaker in every respect during the past few weeks. The demand has fallen off and prices have declined materially. On the whole the tone of the market is not as good as formerly and prospects for the future are not very bright.

The principal cause for the slump is the peace talk, which has caused dealers and users to go slow in making future purchases. In fact all of the users are buying from hand to mouth and are loath to accumulate stocks for the future. Supplies are not large in any section and there is not much elasticity to the market.

Brass is weaker and it is a difficult matter to make quotations, as prices are mixed. Copper is also weaker and the same is true of aluminum. Type metals continue rather strong, although some weakness is apparent in that line of metals. Babbitt is firm. Zinc and tin are also lower, and there is not as much demand as formerly.

The Cleveland Aluminum Casting Company, Cleveland, Ohio, has increased its capital from $10,000 to $25,000.—J. W. L.

CLEVELAND, OHIO

JANUARY 8, 1917.

With the close of the year the most significant factor entering into the conduct of the metal industry of Cleveland and vicinity is the rumor for peace among the warring nations abroad. While there is still a remote possibility of this point being achieved, the talk of peace has had some effect upon the business here. It has stimulated the demands upon plants in this territory. This is contrary to all expectations, for it has been long considered here what effect the stopping of the war is going to have upon all business in the Cleveland district.

In the first place there are sufficient orders on hand in most plants to keep them running for a long time without additional business being taken. Secondly, practically all business with which shops here are identified is for domestic consumption. Thirdly, this domestic demand is so far reaching that, war or no war, needs must be supplied for some time to come.

The past year, without fear of contradiction, may be set down as the best in the history of the local trade. This is best exemplified by the fact that stocks of brass, copper, zinc, aluminum, nickel and the like were never so low as they have been during the last few months. This has made for unprecedented prices, but they have been paid for by the ultimate consumer, he sharing alike in the general prosperity pays his share, grudgingly, perhaps, but pays nevertheless.

Sensational demands for automobiles in Cleveland are primarily responsible for the exceptional business in Cleveland during 1916. This is reflected especially in plants making lamps, parts and accessories. Probably the most significant development has been the removal here of several automobile plants from Detroit, which city heretofore has considered itself as having a monopoly over that industry. In addition, many new companies have established plants in Cleveland. In all at least ten new automobile plants have started operating here in the last six months.

What the year 1917 holds out to the operators in the metal industry is at the outset problematical, because the influence of the war abroad must be felt.

With the turn of the year, however, the most potent factor to be reckoned with is the fuel situation. All lines of industry are working toward settlement of this stringency in both natural gas and fuel, but so far with little success. Latest action by the Public Utilities Commission in ordering the East Ohio Gas Company to discontinue serving gas to industrial concerns, in order that domestic consumers may have sufficient pressure during cold spells, is the first evil effect upon plants here. Practically all non-ferrous metal-working establishments have been using gas. It is not these that are the big consumers, they claim, but much larger institutions that are draining the mains of as much as 1,500,000 cubic feet monthly. To change to coal operation means tremendous expense to the trade at large.

Changing to coal at this time will not alleviate the situation, however, as far as continuing operating is concerned. Coal was never so scarce here as it is with the beginning of the new year. Prices are advancing weekly, but aside from price, it is a matter of conjecture whence will come the fuel.

The car situation enters here. Recent enactment of the Interstate Commerce Commission's ruling on increased demurrage charges was expected to bring relief. The practice of railroads in bunching cars has made it impossible for consignees to comply with this ruling, and the matter has been taken before the Ohio Railroad Commission. Hearings will be heard early in January looking to the settlement of the situation, if possible.

Under these conditions plants are not being enlarged here. Instead, firms are increasing their output by overtime and double-shift methods. In this manner they will keep abreast of their demands, without additional outlay in plant equipment or construction.

One organization that starts the new year with enlarged capacity is the B. M. Gardner Company, one of the largest local firms distributing brass, copper and allied products. The company has just completed a warehouse at 636 Frankfort street, where all forms of brass and copper, bronze sheets, rods, tubes and similar materials will be stored. The object of establishing this warehouse, according to C. E. Conover, secretary, was to make it possible to care for the customers' immediate wants. A feature of the new establishment is a retail department, where small quantities of material will be sold to inventors, experimentalists, and the like. The offices of the company will continue to be maintained in the Citizens' building. B. M. Gardner is president of the concern.

The second huge merger in two months has been completed here with the uniting of the Cleveland Metal Products Company, the Cleveland Factory Company and the Cleveland Foundry Company. The new concern is capitalized at $1,000,000 and is known as the Cleveland Metal Products Company. The manufacture of sheet aluminum and aluminum kitchen utensils will be the feature of the business, although blue flame kerosene stoves also will be produced.

The Automatic Signal and Appliance Company has been placed under the management of a receiver, Attorney Alfred Safran being appointed by Municipal Judge Moylan. The appointment follows a judgment granted the Aluminum Casting Company. The receivership is part of the plan for reorganization, according to President John H. Hoge.—C. C. C.

CINCINNATI, OHIO

JANUARY 8, 1917.

With the close of 1916 the metal industries in this vicinity saw the most prosperous year in their history, and probably the most exciting and eventful as well, pass into history. In spite of the high prices of copper, zinc, lead and, in fact, all other metals, prosperity was never more general among the several metal trades, nor activity greater, than during the year just past. As a matter of course, the high cost of materials was passed on to the consumer as a part of the price of the finished product, whether a casting for use by a machine-tool manufacturer, or the finished machine made by the manufacturer for use in a machine shop or munitions plant. Moreover, the demand was such that prices became a secondary consideration with buyers, and inasmuch as supply and demand fixed prices, almost invariably, it can be understood that conditions were highly favorable to exceptionally profitable work. When it is added that capacity operations were the rule, double and even triple shifts of men being used by the machine-tool makers whenever the men could be had, it becomes apparent that nothing was lacking to make 1916 all that could be desired in the way of business.

Convincing proof of the satisfactory nature of the year's business and the prosperity of the trade is given in the ambitious construction plans either completed, carried out or projected for the immediate future by many members of the trade. Several of the large machinery concerns which are leading users of metal products, and the chief customers of the Cincinnati foundries, have either finished or are planning large additions to their plants, and one, the R. K. LeBlond Company, is finishing an entirely new plant in Hyde Park. The Edna Brass Manufacturing Company, a leading foundry, has completed a modern and substantial addition to its plant on Hunt Street, and many other members of the trade are finding themselves

cramped in quarters which even a year ago were more than ample for their business. The only drawback to business, in fact, has been the limited supply of skilled labor available, although Cincinnati is more fortunate in this respect than many other cities; and the recent stimulus given to peace talk and prospects has naturally caused some let-up, in view of the large amount of business handled by local concerns due either directly or indirectly to the war.

Unquestionably there will be some diminution of business should the war terminate soon, or if contracts for machinery and supplies necessitated by the war are suddenly terminated. As a rule, however, such contracts are not subject to termination without due compensation to the contractors; and, on the other hand, it is generally believed that after the first shock of a radical change in conditions, exactly similar to that which the war itself caused, the cessation of the terrible destruction of life and property in Europe cannot have an effect other than beneficial in this country, including Cincinnati. The immense amount of money now in the hands of American bankers and business men will exert a stimulating influence on business for years to come, it is pointed out, and with the plans which are under way for the capture of foreign business in all parts of the world, it is confidently felt that American manufacturers cannot suffer any pronounced hurt for a long time to come.

The Ohio State Telephone Company, operating lines all over Northern and Central Ohio, has been experimenting with steel wire, coated with aluminum, as a substitute for copper wire, on account of the almost prohibitive cost of copper for use in telephone wires, and it is said that the new wire is perfect for the purpose, besides clearing of ice much more quickly than copper. Large installations will be made in new construction if further tests also prove satisfactory.

Employes of the Dayton Metal Product Company, of Dayton, O., the Domestic Engineering Company, and the Dayton Engineering Laboratories Company have been meeting regularly for discussion and social contact, the meetings being known as "Triangle Assemblies," on account of the three companies involved. Over 700 employes have been present at some of the meetings.

A substantial change in interest in the Buckeye Iron & Brass Works Company, of Dayton, O., one of the leading metal concerns of the city, took place recently with the retirement of President Edward G. Pease on account of ill-health. Mr. Pease disposed of his majority interest in the company, W. B. Anderson, Torrence Huffman and his son W. P. Huffman being the purchasers. Following the change in stock control officers were elected as follows: President, William B. Anderson; vice-president, Robert C. Anderson; secretary and treasurer, William P. Hoffman; assistant secretary-treasurer, George W. Brunett. The Buckeye Iron & Brass Works Company was incorporated in 1876, succeeding the firm of Hoglen & Pease, composed of the late George W. Hoglen and Charles E. Pease, which is turn succeeded Hoglen & Graflin, a firm organized in 1860. The company manufactures a full line of brass goods for enbine builders and gas and steam-fitters, being a leading figure in this branch of the metal trade. It is incorporated for $75,000, but it is understood that this amount is to be materially increased, in order to finance proposed plant extensions.—K. C. C.

LOUISVILLE, KY.

JANUARY 8, 1917.

According to the majority of the copper-working concerns of Louisville business handled during the 1916 season showed a very gratifying increase, in some cases the year proving the best experienced in several seasons. Starting early in 1916, coppersmiths were called upon to do a lot of heavy work in connection with remodeling beverage whiskey plants into alcohol distilleries, and this work kept several firms busy for months. In addition the demand for general castings was exceptionally good, due to the fact that manufacturers of nearly all commodities have been busy, bearings had to be replaced, patterns made up, and in many cases the manufacturers used an increased volume of brass goods in manufacturing their wares. There was also a largely increased consumption of brass plumbing goods, plumbing having shown a big increase. A number of the concerns are carrying a lot of work over into the new year, and are generally of the opinion that 1917 will prove another banner season.

The Vendome Copper & Brass Works report that 1916 was by far the best year the company has ever known, and this is borne out by the fact that the company is now enlarging its plant, and completing certain improvements started in 1916, but held up due to a rush of business which made it impossible to go ahead with the work. At present all hands are busy, and enough work is being carried over to keep things humming for some time.

The Independent Brass Works reports that 1916 was a better year than the three previous ones, and that the concern is rushed with business. At present it is doing a lot of casting in brass and bronze for the Lousville Railway Company, the Cheatham Switch Company and the Standard Milk Machinery Company.

Another concern that has had a prosperous year is the C. Lee Cook Manufacturing Company, which for several weeks has been very busy with special bronze castings for use in copper mine and milling operations, and also some government work.

The increase in business at the Ahrens & Ott plant, of the Standard Sanitary Manufacturing Company, at Louisville, was shown in the recent declaring of an additional dividend on the company's stock. The brass manufacturing and plating departments have been especially busy.

It is reported that the Maggard-Bradley Company, of Morehead, Ky., manufacturers of the Cosmograph motion picture machine, a small nickeled-plated, brass instrument, for home and small exhibition owrk, have closed their plant at Morehead, and transferred their interests to Cincinnati, where the business is carried on by the Cosmograph Sales Company.

At Madison, Ind., the plant of the Tower Tack & Manufacturing Company, owned by the Tower Manufacturing Company, of Cincinnati, Ohio, was recently burned at a loss of $100,000, insured for $50,000. It was stated that the company had orders on hand for two years' output, and that the plant would be rebuilt. For several months two shifts were employed in the plant.—O. V. N. S.

TRENTON, N. J.

JANUARY 8, 1917.

The year just closed has been a very successful one along the metal industry lines, and some of the manufacturers claim that it was the busiest year they had in some time. Manufacturers have had two serious things to contend with during the past year. The war caused the prices of various kinds of metal to soar to the top notch, and on top of this many were compelled to grant increases in wages to hundreds of workmen or else face a strike and lose money as a result.

The Jordan L. Mott Company, perhaps, faced more labor difficulties than any other works in this section. Strikes occurred in the different departments and increase pay had to be given the employes because the season was a busy one. The munition workers also took advantage of the busy times to demand more money. It was a case of "making hay while the sun shines" with the extra men employed on war orders. They knew that they would be discharged when the orders were completed and deemed it best to make all they could while the market was good. The Mott company, aside from the manufacture of munitions, finds business better in its other departments.

The McFarland Machine Company has had a successful season in the manufacture of brass and bronze castings. Frederick Staples, secretary and general manager of the company, says he believes there will be no let up in business for at least six months to come. He said that at the present time many concerns were buying for a year ahead and that this was a good sign. He belived that the number of new shipyards organized during the past year along the Delaware river had a lot to do with the general business picking up.

William G. Wherry, president of the Skillman Hardware Manufacturing Company, who recently returned from a long trip through the West, says he never found business any better. "Although our business is very good and things look bright for the future," he said to a representative of THE METAL INDUSTRY, "we cannot tell what the end of the war will mean. It may cause a big slump or it may cause business to continue good. There is no telling what might happen."

The Ingersoll-Trenton Watch Company reports that business has been very good during the past twelve months and that it continues good. The company believes that the coming season

will also be a prosperous one. This company ships plenty of products abroad, where there is a demand at the present time for low-priced watches.

The Billingham Foundry and Machine Company has had a very prosperous season. During the early spring business was only fair and as the summer advanced orders became more plentiful, and additional experienced help had to be engaged in the brass department. Nearly every month extra hands were hired and additional benches provided for the men. The company now has orders on hand to keep the plant busy for some time to come.

The Trenton Smelting and Refining Company always finds a ready market for its goods, there being a big demand for metals of all kinds. Both the Trenton plants of the concern are busy and look forward to a busy winter and spring.

John W. Metz, president of the National Electro Plating Works, says his business expanded some during the late summer and fall. He is unable to forecast what the winer and spring will be in the metal line. The Trenton Malleable Iron Company is filling orders for brass castings, the demand for the same having increased lately.

The Trenton Brass and Machine Company, East Trenton Electro Plating Works, Standard Fuse Corporations, Mercer Automobile Company, Bechtel Engraving Company and the John A. Roeblings Sons Company have experienced a busy season.

Two new concerns in the metal line have been started here during the past year. Morris Movshovitz & Son built a new plant along the Delaware river at the foot of Fair street, where they are manufacturing high-grade spelter zinc. There is a big demand for good zinc from the watch companies in the East, and the Movshovitz company has orders on hand to furnish these factories with pure zinc.

The Trenton Chemical Company, which was recently organized and which is now engaged in the manufacture of zinc oxide from scrap metals, will enlarge its plant on North Willow street during the early spring.—C. A. L.

NEWARK, N. J.

JANUARY 8, 1917.

The past year has been one of progress in the metal industries of Newark. Nearly all the concerns interviewed report the year the best that they have had for several years in regards to the volume of business done. Profits have not always been as large as the increase in the volume of trade would indicate, though most, if not all, of the local manufacturers have raised the prices of their finished products to cover the extra cost of materials and manufacture. Business conditions, generally, are much better than they were a year ago. The fact that conditions in Newark were duplicated in so many places throughout the country means continued good business in the immediate future, for it has given the retail dealers throughout the country more ready money than they have had for some time, and has given them a renewed confidence such as they have not had for some time before.

While the holiday season was fairly good a year ago, the lack of confidence which was so widespread in the first half of 1915, had not entirely disappeared. Business was good, but it was spotty. It may be a trifle spotty now, but, in this city at least, one of the outstanding features of business in general has been a wider diffusion of good business and the restoring of confidence. Before the recent election there was a great deal said by business men and manufacturers about the blunders of the administration which had reacted unfavorably on business, and the perils to business if President Wilson were re-elected, but in spite of this, and the fact that President Wilson was re-elected, business has continued to improve, and seems on a much firmer foundation now than a year ago.

The past year has not been an easy one by any means for the metal industry in Newark. It has been full of perplexities. Prices were so changeable that manufacturers did not know whether they should order for a long time ahead at current prices, for fear the goods would cost more later, or whether they should order for the immediate future only, in fear that there would be a break in prices, which would leave them with a lot of high priced metal on their hands. When the orders were placed, it was sometimes months before the deliveries were made. There were numerous restrictions on deliveries that ordinarily the local manufacturers would not have stood for, but which they were obliged to accept if they were to get any metal at all. Sometimes it was almost impossible to get materials at any price. Often when the goods were made and shipped, the shipments were delayed by congested transportation, embargoes, etc. These and many other obstacles had to be overcome, yet, notwithstanding it all, business was good.

Platers have been busy through the year, most of them reporting a satisfactory year. Platinum has been so high through the year that scrap has been secured from every conceivable source. Silver has also gone up greatly in price. Copper is very high, and there is a demand for aluminum that eats up all the supply. Brass has been in such demand that it has at times been difficult to get supplies, and the price has been very high.

During the last week of December and the first week or two of January many of the metal factories have been closed for their semi-annual overhauling of engines, machinery, etc. R. B. M.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Taunton Copper Company, Taunton, Mass., is building an addition, 24 x 80 feet, one story.

The Ross-Tacony Crucible Company, Philadelphia, Pa., will build a three-story brick plant, 70 x 100 feet, at a cost of $33,900.

Logemann Brothers, 3130 Burleigh street, Milwaukee, Wis., manufacturers of baling presses, etc., is constructing a 50 x 75 feet addition to its plant.

The Chase Metals Works, Waterbury, Conn., is constructing a two-story addition, 100 x 400 feet, to its plant. This company operates a casting shop and rolling mill.

The Union Smelting & Refining Company, Fourteenth street and Avenue D, New York, has purchased 11 acres of land in Newark, N. J., and is making plans to construct a plant.

The Supples-Biddle Hardware Company, Monel metal department, Philadelphia, Pa., announces that A. R. Levin will be associated with them as manager of the New York office at 30 Church street.

The Kalbfleisch Corporation, 31 Union Square, New York, N. Y., will expend $200,000 for the erection of a building and for equipment for a plant at Chattanooga, Tenn., for the manufacture of sulphate of aluminum.

The Fixture Spray Company, manufacturers of spraying equipment for lacquering, enameling, japanning, etc., have moved from 2650 Broadway to 549 West Twenty-second street, New York.

A. Allan & Son, 486 Greenwich street, New York, manufacturers of Allan anti-friction metal, are now receiving bids for their new model foundry which they expect to start work upon in a short time at Harrison, N. J.

The Bayonne Casting Company, Bayonne, N. J., manufacturers of Monel metal, bronze castings, etc., has awarded the contract for the construction of a storage building for Monel metal rods and casting materials, to cost about $4,500.

Life insurance policies and profit-sharing premiums to the approximate value of $1,000,000 were distributed on December 23, 1916, to 900 employes of the Sperry Gyroscope Company, Brooklyn, N. Y., manufacturers of gyrocompasses, ship stabilizers and high-intensity searchlights.

The Aluminum Goods Manufacturing Company, Manitowoc, Wis., is considering the establishment of a rolling mill in connection with its main works in Manitowoc, to serve also the plant in Two Rivers, Wis., although the company reports that nothing definite has been decided as yet.

The New Jersey Tube Company, Harrison, N. J., manufacturers of sheet brass and brass tubing, will build a one-story addition to its plant, 120 x 280 feet, on Kingsland avenue. The company operates a brass foundry, casting shop, rolling mill, cutting-up shop, and stamping and brazing departments.

The Rome Brass & Copper Company, Rome, N. Y., has completed plans and has started the erection of a one-story casting shop, 100 x 200 feet. The company operates a smelting and refining department, brass foundry, brass machine shop, tool room, casting shop, rolling mill and tinning and polishing departments.

It is reported that preparations are being made for the construction of the $5,000,000 refinery at Port Colborne, Ontario, Canada, by the International Nickel Corporation, New York, N. Y. It is also reported that the British American Nickel Company will start work soon on the erection of a refinery in the Welland, Ontario, district.

The Roessler & Hasslacher Chemical Company, New York, N. Y., announces that the erection of its plant near Charleston, W. Va., is progressing and that its completion depends entirely upon weather, material and labor conditions. The cost of the erection of this plant will fall below $500,000, and not cost $1,000,000 as was reported.

The Eagle-Picher Lead Company, with main offices at Chicago, Ill., have started their Henryetta, Okla. spelter smeltery, which the company announces is modern throughout. At present this company operates 5 lead and 2 zinc smelteries. Last June they combined with the Eagle Lead Company of Cincinnati, Ohio, which is one of the oldest lead concerns in the United States.

The American Metal Works, Armat and Heiskel Streets, Philadelphia, Pa., has purchased a site of about 4½ acres on the Reading Railroad, near Wayne Junction. It has a frontage of 553 feet and the company will erect a factory on part of the plot at an estimated cost of $125,000 and will sell the remainder to other manufacturers. This company operates a drawing, stamping, plating and polishing departments.

Frank L. Driver, president of the Driver-Harris Wire Company, Harrison, N. J., has gone to Manchester, England, where he will be present at the opening of the new factory of the Driver-Drennan Cooper Company. The opening of the plant is the result of a visit made by Mr. Driver to England a short time ago when he made an extensive study of the wire industry. This new plant was constructed to obviate the difficulties met with and which were due to the war in shipping the finished material from the Harrison plant to England, and raw material will be shipped from this country for finishing at the Manchester factory.

Interests closely allied with the Ordnance Engineering Corporation and the British American Agency, Ltd., concerns which have become well known to all American manufacturers in any way interested in munitions or metals for domestic or foreign purposes, have recently acquired controlling interests in Leygrand & Company, London, England. It is understood that company has very strong connections in the metal world, particularly in the marketing of aluminum, either in ingot, billet, wire or powder form. The company's New York office will be located in the Equitable building.

In connection with the conventions held in New York during the week of December 26, 1916, there was held a very interesting exhibition at the American Museum of Natural History by the American Association of Advancement of Science of chemical products and apparatus used in making historic discoveries in chemical science. This exhibit included apparatus which Joseph Priestly used in his experiment in the discovery of oxygen in 1774. Samples of various metals and elements as they are found in nature and also a large variety of commercial products were also shown, including an extensive exhibit of electroplated objects exhibited by the American Electrochemical Society.

The Buffalo Foundry & Machine Company, Buffalo, N. Y., has placed a contract for a new laboratory building 75 by 90 feet, which will take care of the chemical and physical laboratory in connection with its foundry and also the laboratory and testing plant connected with the vacuum drying business. The company expects in the future to build an addition to the pattern storage building, and which will be about 52 by 140 feet.

The Mueller Manufacturing Company, manufacturers of plumbing and gas brass goods, Sarnia, Ontario, Canada, announces that it is making arrangements to double the capacity of its brass plant, due to increased business in castings and jobbing work, in all kinds of brass, bronze, aluminum, etc. The company is also doing considerable work in the way of refining metals and making ingots, but they are also in the market at all times for ingots, chips, scrap of all kinds and various other classes of soft metals and are considering the erection of a cupola, reverberatory furnaces or any other apparatus for taking care of and refining soft metals, for making ingots and necessary equipment for drawing tubes and making rod brass.

CHANGE IN FIRM NAME

After January 1 the name of the Titan Copper Products Company, manufacturers of bronze, brass and aluminum castings, 376 Massachusetts avenue, Buffalo, N. Y., will be known as the Kendall Foundry Company.

CHANGE IN ADDRESS

The General Bakelite Company, manufacturers of Bakelite lacquers, etc., formerly located at 100 William street, has removed its general offices to 2 Rector street, United States Express building, New York, N. Y.

BUSINESS TROUBLES

William E. Tuttle, Jr., of Westfield, N. J., has been appointed receiver of the C. & C. Electric & Manufacturing Company, Garwood, N. J., by the United States District Court, in an action brought by the American Brass Company, Waterbury, Conn., on behalf of itself and all other creditors of the company. The action of the American Brass Company has the full approval of the creditor's committee, of which Thomas L. Green, of the American Brass Company, was chairman. The business of the C. & C. Electric & Manufacturing Company will continue without interruption.

CHANGE OF OFFICERS

Some changes in the personnel of The Metals Trading Corporation of 99 John Street, New York, which were brought about by deaths and the transfer of different officials are as follows: Federick Lightfoot has become treasurer; C. M. Gilpin, secretary; W. F. Roohan is now assistant to the president, Russell A. Cowles, who is the founder of the business. A. Staheli remains as vice-president; Irving A. Brown, formerly assistant to the president, is now manager and secretary of the Sandusky Foundry & Machine Company, Sandusky, Ohio, one of the corporations controlled by Mr. Cowles. W. H. Hyndman takes Mr. Brown's place as the assistant secretary to The Metals Trading Corporation.

INCREASE IN CAPITAL STOCK

The Dominion Copper Products Company, Lachine, Quebec, Canada, has increased its capital stock from $1,000,000 to $3,500,000. The company is one of the subsidiaries of the Dominion Bridge Company of Montreal, which started with a capital of $400,000 and increased it to $1,000,000 last August. Another subsidiary of the Bridge company is the Montreal Ammunitions, Limited, with a capital of $300,000. It has been intimated that a consolidation of the two companies is under consideration. The Dominion Copper Products Company operates the following departments: Smelting and refining, brass machine shop, tool room, casting shop, rolling mill, cutting-up shop and stamping.

U. S. ELECTRO-GALVANIZING COMPANY EXPANDING

An extension of the U. S. Electro-Galvanizing Company's plant, compelled by the growth of its business, has been started with the purchase of an additional building at 278-284 Park avenue, Brooklyn, N. Y. This building will be devoted to the manufacture of automatic machinery for nickel plating and electro galvanizing, of which the company has six patented types. A laboratory for the testing of new solutions, materials and plating and cleaning methods is being installed. Job galvanizing will be confined to the building at 1 to 9 Park avenue. The company, since 1896, has been a pioneer in the invention and development of automatic handling devices for cleaning, electro plating and electro galvanizing various material, and with the added facilities a number of new apparatus which are now in their inception will be perfected.

DIVIDENDS

The New Jersey Zinc Company, New York, N. Y., has ordered a profit-sharing distribution to employes equal to fourteen per cent. of their wages for 1916, which will be paid in quarterly instalments during 1917.

The Doehler Die Casting Company, Brooklyn, N. Y., has declared a wage dividend amounting to ten per cent. per annum based on all wages actually received. This wage dividend is subject to several conditions, which are determined by the length of time the participant has been employed by the company.

The American Brass Company, with large plants in Waterbury, Ansonia and Torrington, Conn., has given, in addition to the ten per cent. bonus paid to its salaried people during the year 1916, an additional bonus of 25 per cent. Also beginning with January 1, 1917, all employes of the company, other than salaried people, will receive a straight advance of two and one-half cents per hour, and such adjustment of piece-work rates will be made as may be equitable. Ten per cent. will be added to the rate formerly paid to salaried employes for the coming year.

NEW ANNOUNCEMENTS

The announcements of a number of new concerns and new products are made in this issue of THE METAL INDUSTRY, among them being the Vesuvius Crucible Company, Swissvale, Pa.; Crucible Company of New Jersey, Perth Amboy, N. J.; Neu Metals and Process Company, Inc., Reading, Pa., manufacturers of Neu-Lead.

Other newcomers or renewed advertisements are the Hampden Corundum Wheel Company, Springfield, Mass.; Herman Hegt, New York, brass mill products; Vapor Valve Company, St. Louis, Mo., lacquer sprayers; Charles W. House & Sons, Unionville, Conn., felt polishing wheels and washers; Adolf Neubeck, Buffalo, N. Y., nickel salts; Charles F. Kenworthy, Waterbury, Conn., annealing furnaces; Titan Metal Company, Milesburg, Pa., Titan bronze; Bridgeport Testing Laboratory, Bridgeport, Conn.; Thwing Instrument Company, Philadelphia, Pa., pyrometers, etc., Pangborn Corporation, Hagerstown, Md., sand blasts; Hoevel Manufacturing Corporation, New York, sand blasts; Louis Weil, New York, metals; Northern Engineering Works, Detroit, Mich., cranes, etc.; Miner & Peck Manufacturing Company, New Haven, Conn., drop presses and lifters; Great Western Smelting Company, Chicago, Ill., metals; American Oil & Supply Co., Newark, N. J., clay crucibles and melting furnaces; Peninsular Smelting Company, Detroit, Mich., metals; Precision Die-Casting Company, Syracuse, N. Y.; Eastern Machinery Company, New Haven, Conn., cinder crushers; James Clark, Jr., & Co., electric portable drills; Theo. Hiertz Metal Company, St. Louis, Mo., metals; Goshen Eyelet Company, Goshen, Ind., stamping and forming; W. N. Best, Inc., New York, furnaces and burners; Frank W. Henry, Philadelphia, chemical plumbing and lead burning; American Manganese Bronze Company, Philadelphia, Pa., metals; New Jersey Foundry & Machine Company, New York, crucible tongs; Matthew Tanzola, solderer; Hauser-Stander Tank Company, Cincinnati, O., platers' tanks; Rome Wire Company, Rome, N. Y., copper rods and wire; Walker M. Levett Company, New York, aluminum alloys and magnalite; Harshaw, Fuller & Goodwin Company, Cleveland, O., nickel anodes and nickel salts; United Zinc Smelting Company, New York, spelter; Consolidated Press Company, Hastings, Mich., stamping and other presses; John W. Masury & Sons, Brooklyn, N. Y., acid-resisting paint; Fixture Spray Company, New York, Saxowhite spray process; Ele-Kem Company, Chicago, Ill., platers' supplies; H. A. Stiles & Co., Boston, Mass., emery and other abrasives.

FOREIGN TRADE OPPORTUNITIES

For addresses of these inquiries apply to Bureau of Foreign and Domestic Commerce, Washington, D. C., and give file numbers.

Metals, No. 23359.—A company in Norway desires to purchase shipbuilding materials, such as plates, angles, tees, boiler materials, anchors, chains, wire; also brass and copper tubes. Quotations should be made c. i. f. destination. Correspondence in English. Reference.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To Manufacture Brass and Metal.—Barlow Foundry Company, Newark, N. J. Capital, $250,000. Incorporators: William Fellowes Morgan, Short Hills, N. J.; Walter Kidde, Montclair, N. J.; Samuel Dixon, Newark, N. J.

To manufacture, deal, export and import metals and metal products.—Waltz and Company, 50 Church street, New York. Capital, $50,000. Incorporators: James L. T. Waltz, president and treasurer; Amos S. Neuberger, vice-president and assistant treasurer, and Charles P. Verkruzen, secretary.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Thermal Apparatus.—The Leeds & Northrup Company, Philadelphia, Pa., manufacturers of electrical measuring instruments, has issued Bulletin 866-A, which is devoted to apparatus for the location of thermal transformation points. These transformations or critical points, it is stated, occur when material is being heated and cooled and are termed decalescent and recalescent respectively.

Cleaning Chemicals.—The International Chemical Company, Camden, N. J., has issued a series of leaflets devoted to varied lines of cleaners for metal work, which this company manufactures. These materials are adapted for preparing metal surfaces for plating, lacquering, japanning, tinning, galvanizing and dipping, and the company will be pleased to send full information regarding these compounds.

Die Castings.—The Doehler Die Casting Company, Brooklyn, N. Y., manufacturers of die castings, has issued a very handsome and artistic catalog in the interest of its products, entitled "Creating An Industry." The catalog gives a description of the evolution of the art of casting of metals from prehistoric to modern times. The catalog contains sixty pages and is finely illustrated with half-tone engravings of Doehler products and the various factories in which they are made. The catalog concludes with a department devoted to reproductions of letters of approval of the various customers of the firm.

Alloys.—R. A. Wood has issued sixty additional pages for the "Waterbury Book of Alloys," which was reviewed in THE METAL INDUSTRY for November, 1915. These pages are devoted to malleable nickel alloys and cover the ground completely in regard to directions for the production of and formulas for all the malleable nickel alloys now being used in the metal trades. These alloys include nickel-silver of various grades, brazing solder, cupro-nickel, cutlery stock and a long list of metals used for miscellaneous purposes, such as platinoid, platinite and jewelers' and platers' bars, invar, manganin, and so forth. These pages are supplied only to subscribers for the "Waterbury Book of Alloys," which is sold for $5.

Glue Heating Appliances.—The Advance Machinery Company, Toledo, Ohio, have issued a sixty-four page catalog giving full descriptions and illustrations of their Advance-Toledo glue heating appliances and Advance-Wetmore glue heaters. These appliances are designed and constructed on modern and scientific lines for the correct preparation of glue, dextrine, casein, paste, paraffin, starch and other adhesives, in styles and sizes for all requirements.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW OF 1916—OUTLOOK FOR 1917

BY J. J. ARCHER.

REVIEW.

In our review of a year ago 1915 had been the greatest business year this country had ever seen, but the year 1916 has far outstripped it. Taking the exports of merchandise for 1916, the total at present writing has not been compiled, we find the month of November, 1916, shows the highest record of the country's exports of merchandise for any single month in the history of the country, when the total was $517,900,000, or $158,600,000 above any previous maximum, which was $359,300,000 in December, 1915. The smallest total in 1916 was in January, $335,535,303. Iron and steel and copper were the principal metals affected during 1916, pig iron selling at $36 a ton at the furnace, and copper close to 36 cents a pound. The advance in pig iron was probably legitimate, and due to more or less natural causes, but the artificially inflated copper prices are altogether another story.

The year 1916 stands pre-eminently as the greatest money making year this sordid money-mad country has ever seen. From a materialistic standard this country has reached the highest pinnacle of success, and the whole country is content and smug with itself. The "high ideals" this country was supposed to stand for are today mere catch-words, old-fashioned and forgotten. Peace, ease and prosperity is now the slogan and seem to stand today as the highest "ideals" this country is capable of. Nothing else matters. All else is forgotten. So much for the year 1916 and the ennobling American ideal of peace, ease and prosperity. It is not a year to be proud of.

OUTLOOK FOR 1917.

The outlook for 1917 is anything but bright. Already we see the "writing on the wall." An English steel mill at Sheffield has underbid American firms on contracts for 14-inch and 16-inch shells to the amount of $146 on the 14-inch and $237 lower on the 16-inch on each shell, and make deliveries in 11 and 16 months against 22 and 24 months required by the American firms, and the English firm pays the duty. It is time for American manufacturers to sit up and take notice. These abnormal war prices are going to melt away. Europe is efficient as never before in its history. Russia is waking up, Japan has learnt its lesson. A fearful readjustment will have to be consummated before America can compete or even hold her own trade against Europe. Labor is going to be the trouble, and unless the labor trust, otherwise the labor unions, are made amenable to the Sherman law business will be at a low ebb. These high prices and unlimited profits are not going to last. I may be wrong, but I can only see drastic readjustments ahead and any amount of business unsettlement for 1917.

COPPER.

Knowing what we know today about the actual production of refined copper for the year 1916, it is difficult to write a correct review of the copper market for the reason that the reports of the market as published monthly, weekly and daily have been on a false basis, consumers have been misled, and the reports have not been in accordance with the correct facts of the situation.

Had consumers known, as they should have known, that the production of copper for the last half of the year 1916 was at the rate of 225,000,000 pounds each month, we would never have had any 35-cent copper, and it is doubtful if the price would ever have gone above 25 cents. As it was consumers were kept in the dark as to the actual facts, the production was stated to be about 175 to possibly 185,000 pounds at the most, and on this basis consumers were stampeded into rushing in to the market and buying copper probably that they did not actually need for fear, as they were led to believe at the time, that there would not be enough copper to go around. Since those reports were made public millions, and millions of pounds of copper have been sold, and there are probably millions and millions of pounds still for sale. There is no shortage of copper, there never has been any shortage of copper. It looks like consumers of copper have been buying copper almost under false pretenses. The exact facts of the situation were never made known, and consumers were kept in the dark and had to buy on reports of the market as published in the trade papers, and these reports were more or less misleading. It is not a pretty story, and does not look any better in print, but it is based on actual facts.

Of course the most vitally interesting incident in the copper market for 1916, as far as consumers are concerned, are the figures of production of refined copper as compiled by the United States Geological Survey, and published January 2. According to their figures the production of refined copper for the year 1916 reached the enormous total of 2,311,000,000 pounds, or an average of very close to 200,000,000 pounds each month during 1916. To be exact and taking the Survey figures, producers

would have for sale every week during the year 1916 44½ million pounds of copper. That does not look like any shortage of copper, does it? Well, to go back to the figures. The smelter production for 1916 was 1,928,000,000 against 1,388,000,000 in 1915, an increase of 540,000,000 pounds in smelter production over 1915. The refinery output is even more remarkable, 2,311,000,000 pounds in 1916 against 1,634,000,000 pounds in 1915, an increase in refinery output of 677,000,000 as compared with 1915. This increase in refinery output does not match in very well with what the producers have been telling us all the year. The statements were that the refineries were far behind the smelter output, but that by about the first quarter in the coming year (1917) the refinery output would probably be up to 200,000,000 pounds a month, and that was the story we gave out, in all good faith, to the consumers of copper during the last few months. I will go back to the figures again; you must pardon these little digressions or outbreaks; the fact is I feel a little uncomfortable "under the collar," and have to let go at times. To finish the statistics. I will take the government estimate of refined copper available on January 1, 1916, as about 82,400,000 pounds—say 82,000,000 (this seems a very conservative estimate; several others run to 85,000,000 and 90,000,000 pounds). Production, 2,311,000,000 pounds, makes a total available for 1916 of 2,393,000,000 pounds. The exports for 1916 were 730,000,000 pounds, leaving an available supply of refined copper for 1916 of 1,663,000,000 pounds. Now, how much of this enormous amount of copper has been consumed, and how much is being carried by producers over into 1917?

Suppose we say the producers are carrying over into 1917 a stock of 100,000,000 pounds. Our consumption must then have been 1,563,000,000 pounds for the year—say 130,000,000 pounds a month, 32,000,000 a week, or say 6,000,000 pounds a day for every working day during the year 1916. That is just about what the government figures stand for, and consumers can judge for themselves. Regarding the probable production for 1917 I have this on the authority of the producers themselves, that the refinery output during the early months of 1917 will be considerably more than anything they were able to do in 1916. Now, the average monthly production over the entire year of 1916, 192,600,000, the production of the first half of 1916 was probably not over 160,000,000 pounds a month, and for the balance of the year the production must have been at the rate of 225,000,000 pounds a month. Consumers today have the satisfaction of knowing that the refinery output in 1916 was not up to capacity, but on the word of the producers the refineries would be running full by about March 1, and the production of refined copper would then be much larger than anything in 1916. On that basis it would not be altogether improbable nor beyond the realm of reason to figure on a production during 1917 of refined copper of 250,000,000 pounds a month. There is one thing certain. I do not believe that we are going to have any more soaring 35-cent copper markets, and there is going to be more than enough copper to go around. That is the lesson to be drawn from the government figures of the copper production of the year 1916.

The review of the copper market for the year 1916 does not make nice reading. The British government started a buying movement in December, 1915, buying then 60,000 tons for delivery over the first half of 1916. Domestic consumers came into the market, prices rapidly advanced from the low price of 19¼ for electrolytic in December, 1915, to 23½ on January 3, 1916, and producers then began to report they were "sold up to next April." Towards the end of March the British government bought about 43,000 tons for delivery during 1916, and during April about 90,000 tons were secured on options given in March; this copper was all for delivery extending over 1916, and the price was about 26 cents, about the market price ruling in early March.

The buying movement held well into May, and the price of electrolytic went up to 31 cents. In April some of the larger producers were "sold up for second and third quarter," and one large producer stated it would be a difficult matter to find enough copper to fill a Russian inquiry—then on the market—for 15,000 tons of copper for delivery during 1916. After that prices sagged off slightly. Domestic consumers were kept on edge by reports that large government inquiries for copper were in market, but nothing more developed in the way of large foreign governments' orders until later in the year. Towards the end of May the market became dull, prices sagged off, the artificial premium for prompt copper disappeared, and from sales at 30 to 31 cents May broke to 27½, and from then till July prices for electrolytic sagged off to 24½ cents. Some of the larger producers, who had been holding for 29 cents, came into the market as sellers at this time at 25 cents. Russia came into the market around this time, and closed several contracts for lots of 5,000 tons late in July and August, and prices advanced again. Producers now were practically sold out for 1916. Consumers had bought very freely on the fear of a supposed shortage of copper for 1916. You must remember that around this time, July and August, on the word of the larger producers, the production was around 165,000,000 to possibly 175,000,000 pounds a month, but by January or March of 1917 they believed the production would be about 200,000,000 pounds. On September 23 the British government closed a deal for 200,000 long tons of copper, 448,000,000 pounds for delivery over the first six months of 1917. This order was supposed to take about one-third of the total production over the first six months of 1917. The consummation of the sale had no effect on domestic consumers, and the market became dull again. Later in October consumers came into the market, and at that time some large producers were sold up for 1916 and well into the first half of 1917; an enormous business was done for delivery during the balance of 1916 and some into the first half of 1917.

The highest prices of the year were reached about December 11, when the British government stopped all trading in copper in England except on a permit from the government. A few days after this announcement the German peace proposition was let loose, and copper prices rapidly declined; the market became demoralized. Millions of pounds of first quarter copper came on the market. Consumers who had over-bought were sellers, and prices crumbled rapidly from 35 to 36 for prompt to around 28½ cents. First quarter copper from 34 to 35 cents to close to 28 cents at the end of December. Since then prices are lower again, and first quarter copper is offered today at 27 to 27½; second quarter at 26 to 27; third quarter, 25 to 26; fourth quarter at 24 to 25, and last half of 1917 at 25 to 26 cents. This rapid decline came on the first hint of peace, and should this peace move gradually develop, the price of copper is bound to decline.

Consumers should remember that the production of copper today is from 225,000,000 to possibly 240,000,000 pounds a month, and most consumers are over-bought. Do not be stampeded as you were in 1916.

TIN.

The tin market is in a class by itself, and does not in any way follow the ordinary ups and downs of other metals. The metal is controlled entirely by the British government, and the restrictions placed around this metal by the British government seem to be somewhat irksome to this peace-loving, ease-loving "land of liberty" and "freedom." (These last few words are taken from some of the native songs of the country, and are supposed to represent the earnest, fervent feelings and beliefs of its citizens; the songs, however, were written some years ago). In consequence of these annoying restrictions the fluctuations in the tin market have been particularly violent. In January, 1916, 45 cents was the high price of tin in the New York market; the price rapidly advanced to 50 cents in March, the high point for the year, and after that kick-up the prices gradually declined to 37½ in July, the low point for the year. As usual on a declining market nobody wanted any tin, but prices advanced again to 43¾ cents a pound in October, and closed at around 41¾ cents by the end of the year. During the early days of January the price of tin again advanced about 2 cents per pound, and closes today at around 44½ cents.

The tip on tin for 1917 seems to be that, with peace in sight, tin may possibly be worked down to a lower level and then lifted to 50 cents or better. So that now consumers may know what to do.

LEAD.

The price of lead in January, 1916, was 5.50 New York basis, and 5.50 was the price of the independents. Prices gradually advanced, and independents were getting higher prices than the official trust price, which was more or less nominal, and when on January 4 the trust raised their price to 5.75 New York, the in-

dependents were still getting higher prices, and the trust raised its price to 5.90 on January 7. Prices fell off for a time, but on February 16 the price of lead was advanced to 6.30. A big foreign demand sprang up around this time, and the independents were able to make sales at as high as 6.50 cents New York, when the trust was still quoting 6.30 to its own specials. On March 3 the trust went to 6.40, and on March 7 to 6.60, but these prices did not come near to the independents, and sales for export were made at as high as 7½ cents St. Louis. On March 14 the trust went to 7 cents New York, but the independents were then getting 8 cents, and the trust stuck to its 7 cent basis. Later the trust came out with a long, rigmarole statement that they were only in business for the good of consumers and a lot of other twaddle that did not hold together later on when more real tests came along. On March 31 the trust went to 7½ cents; the independents got gradually down to this level, and then went to 5.90 cents New York in August; all metals were more or less weak and unsettled around this time. By September the market became steadier, and the outside price worked up again to 7 cents, and this price held until the end of November. In December the outside market was still advancing and the trust puts its price to 7½ New York. On December 12 prices became unsettled again, and the outside market declined to 7.35, and that was the closing price for the year. The trust prices stood at 7½ cents.

The production of lead for 1916 was 579,600 tons, an increase of 29,500 tons over 1915. The prices of lead for 1916 were the highest on record, and nearly 50 per cent. higher than the average price of 1915.

SPELTER.

The spelter market opened fairly strong and active in January, 1916, after the break in the fall of 1915. The spot St. Louis market opened at around 17¼ cents, with January offered at 17 cents, and February at 16¼ down to 14 cents for second quarter. By February prompt spelter was up to 21 cents St. Louis, but this was the high point for the year, and prices gradually declined to 8.40 in August, and from that basis prices reacted again to 13⅛ cents in December, and closed at around 9¾ cents at East St. Louis.

The total production, according to the United States Geological Survey, for 1916 was 658,000 tons, against 489,519 tons in 1915.

ALUMINUM.

Aluminum prices for the year have made records never before imagined. The price of No. 1 virgin aluminum opened in January, 1916, at around 54 cents, New York, and advanced steadily to 67 cents, the high point for the year, in October. Since then prices have declined about 5 cents per pound, and there are sellers at the close of the year at 61 cents New York. It is astonishing that aluminum prices have not had any heavier decline on the probability of peace in Europe in the not far distant future. Today aluminum is being sold by the British Government to munition makers in England at 43 cents per pound, and this is probably the price in France and to the other allies. In normal times Europe can make and sell aluminum in America at 30 cents a pound, and with peace proposals in the air and more or less probable, aluminum at 60 cents looks like a very dangerous article to handle.

ANTIMONY.

The antimony market has had its ups and downs during the year 1916. Opening in January at around 43½ cents, prices advanced to 45 cents in February, and this was the high price for the year, and prices gradually dropped to 10½ cents, the low point in the year in August; later prices reacted slightly and closed at 14⅜ cents per pound, against 43½ cents in January, 1916.

SILVER.

The silver market has been very active, and opening at 55⅝ cents per ounce prices advanced to 75¼ in May. Later prices declined again, and in July the price was down to 60 cents, and then later down to 55 cents. This was the low price for the year, and in December the price was up to 76¾ cents and closed at 75⅜ cents.

PLATINUM.

The platinum market has been more or less irregular. Opening at $90 an ounce the price declined to $60 in August, and later advanced to $90 and then to $115 per ounce, and closed at $90 at the end of December. It is understood the production in 1916 will be considerably lower than in 1915, which was only about 144,000 ounces.

QUICKSILVER.

Owing to the active demand for quicksilver by the makers of ammunition early in the year, the price of quicksilver was up to $300 per flask. The British Government then allowed a certain amount to be shipped to America to be used on their contracts for ammunition. This had a dire effect on the market and prices gradually declined to $58 per flask in August, the low point for the year. Since then the market has reacted and the price at the end of December was $90 per flask.

SHEET METALS.

The way of the sheet metal market is that it goes up very rapidly and comes down very slowly. There seems to be no basis between the price of ingot copper and the price of sheet copper. Of course there is a fixed cost price of rolling ingots or cakes into sheets, but only in the event of an advance in ingot copper, and there have been several of them during the year of 1916, is an advance in sheet price warranted. In the event of an advance the price of sheets is quickly advanced, and this advance seems to hold until all the high-priced copper has been delivered and rolled into sheets. If ingot copper meanwhile should break 2 or 3 cents a pound, the price of sheets would not be marked down until the high-priced stock had been sold. That is called protecting their trade. A year ago sheet copper was selling at a base price of 28 cents per pound and copper wire at 25-cent base, or an ingot copper market of 23¾ to 24 cents. Today we have an ingot copper market of 31 cents for prompt, and a sheet-copper price of 42 cents, and a copper-wire price of 37½ cents, on account of the war, possibly, or the weather, or the crops. I give it up.

OLD METALS.

The year 1916 has been the biggest yet in the old metal business. Very few setbacks and most good steady advances, and money came along as you slept. One made more money by sleeping than one did by selling. It has been a great year, but the last three weeks, with a drop of 8 cents in copper, has taken quite a lot of the gilt off the gingerbread. But for all that it has been a great year.

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

Lake Copper. 1915—Average for year, 18.94. 1916—January, 24.75. February, 27.75. March, 28. April, 29. May, 29⅞. June, 28.25. July, 27.25. August, 27. September, 28. October, 28⅞. November, 32.25. December, 34.25. Average for year, 28.77.

Brass Mill Spelter, 1915—Average for year, 17.50. 1916—January, 22.25. February, 22.75. March, 23.15. April, 23.20. May, 21.20. June, 17.40. July, 15.20. August, 13.60. September, 13.70. October, 12.95. November, 14.10. December, 13.20. Average for year, 17.725.

DECEMBER MOVEMENTS IN METALS

	Highest.	Lowest.	Closing.
COPPER.			
Lake	35.00	31.00	31.00
Electrolytic	36.00	31.00	31.00
Casting	34.00	29.75	29.50
TIN	45.25	40.70	41.80
LEAD	8.00	7.00	7.35
SPELTER	13.35	9.90	10.00
ANTIMONY (Chinese and Jap.)	14.50	14.25	14.40
SILVER	76¾	75	75⅜

Pig Iron and Metal Products of the United States

Calendar Years 1907-1915. (1916 Estimated)

(FROM THE UNITED STATES GEOLOGICAL SURVEY.)

PRODUCTS. METALLIC	1907 Quantity.	1907 Value.	1908 Quantity.	1908 Value.	1909 Quantity.	1909 Value.	Products
Pig iron (spot value) long tons	25,781,361	$529,958,000	15,936,018	$254,321,000	25,795,471	$419,175,000	Pig iron
Silver, commercial value, troy ounces	56,514,400	37,299,700	52,440,800	28,050,600	54,721,500	28,455,200	Silver
Gold, coining value, troy ounces	4,374,827	90,435,700	4,574,340	94,560,000	4,821,701	99,673,400	Gold
Copper value at New York City pounds	868,996,491	173,799,300	942,570,721	124,419,335	1,092,951,624	142,083,711	Copper
Lead, value at New York City, short ton	352,381	37,352,386	311,666	26,179,944	352,839	30,344,154	Lead
Spelter, value at St. Louis, short tons	223,745	26,401,910	190,749	17,930,406	230,225	24,864,300	Spelter
Quicksilver, value at S. Francisco, flasks	21,554	853,538	19,752	872,446	21,075	957,859	Q'ksilver
Aluminum, pounds	17,211,000	4,926,948	11,152,000	2,434,600	34,210,000	6,575,000	Aluminum
Antimony, short tons	9,910	1,322,985	13,629	1,264,771	12,896	1,231,019	Antimony
Nickel, value at New York, pounds	.....	.....	.....	.....	19,284,172	10,027,769	Nickel
Tin, pounds	.....	33,285	.....	.....	.....	17,499	Tin
Platinum, value (crude) at New York City, troy ounces	357	10,589	750	14,250	638	15,950	Platinum
Total value of metallic products	.....	$907,204,805	.....	$550,047,352	.....	$763,420,861	

PRODUCTS. METALLIC	1910 Quantity.	1910 Value.	1911 Quantity.	1911 Value.	1912 Quantity.	1912 Value.	Products
Pig iron (spot value) long tons	26,674,123	$412,162,486	23,257,288	$327,334,624	30,180,969	$420,563,388	Pig iron
Silver, commercial value, troy ounces	57,137,900	30,854,500	60,399,400	32,615,700	63,766,800	39,197,500	Silver
Gold, coining value troy ounces	4,657,018	96,269,100	4,687,053	96,890,000	4,520,717	93,451,500	Gold
Copper, value at New York City, pounds	1,080,159,509	137,180,257	1,097,232,749	137,154,092	1,243,268,720	205,139,338	Copper
Lead, value at New York City, short tons	375,402	33,035,376	391,995	35,279,550	392,517	35,326,530	Lead
Spelter, value at St. Louis, short tons	252,479	27,267,732	271,621	30,964,794	323,907	44,699,166	Spelter
Quicksilver, value at S. Francisco, flasks	20,601	958,153	21,256	977,989	25,064	1,053,941	Q'ksilver
Aluminum, pounds	(h) 47,734,000	8,955,700	46,125,000	8,084,000	65,607,000	11,907,000	Aluminum
Antimony, short tons	14,069	1,338,090	14,078	1,380,556	13,552	1,311,348	Antim. L'd
Nickel, value at New York, pounds	25,359,544	13,186,963	890,000	127,000	.....	.....	Nickel
Tin, pounds	.....	23,447	.....	56,635	.....	124,800	Tin
Platinum, value (crude) at New York City, troy ounces	773	25,277	940	40,890	1,005	45,778	Platinum
Total value of metallic products	.....	$761,257,081	.....	$670,905,830	.....	$852,720,289	

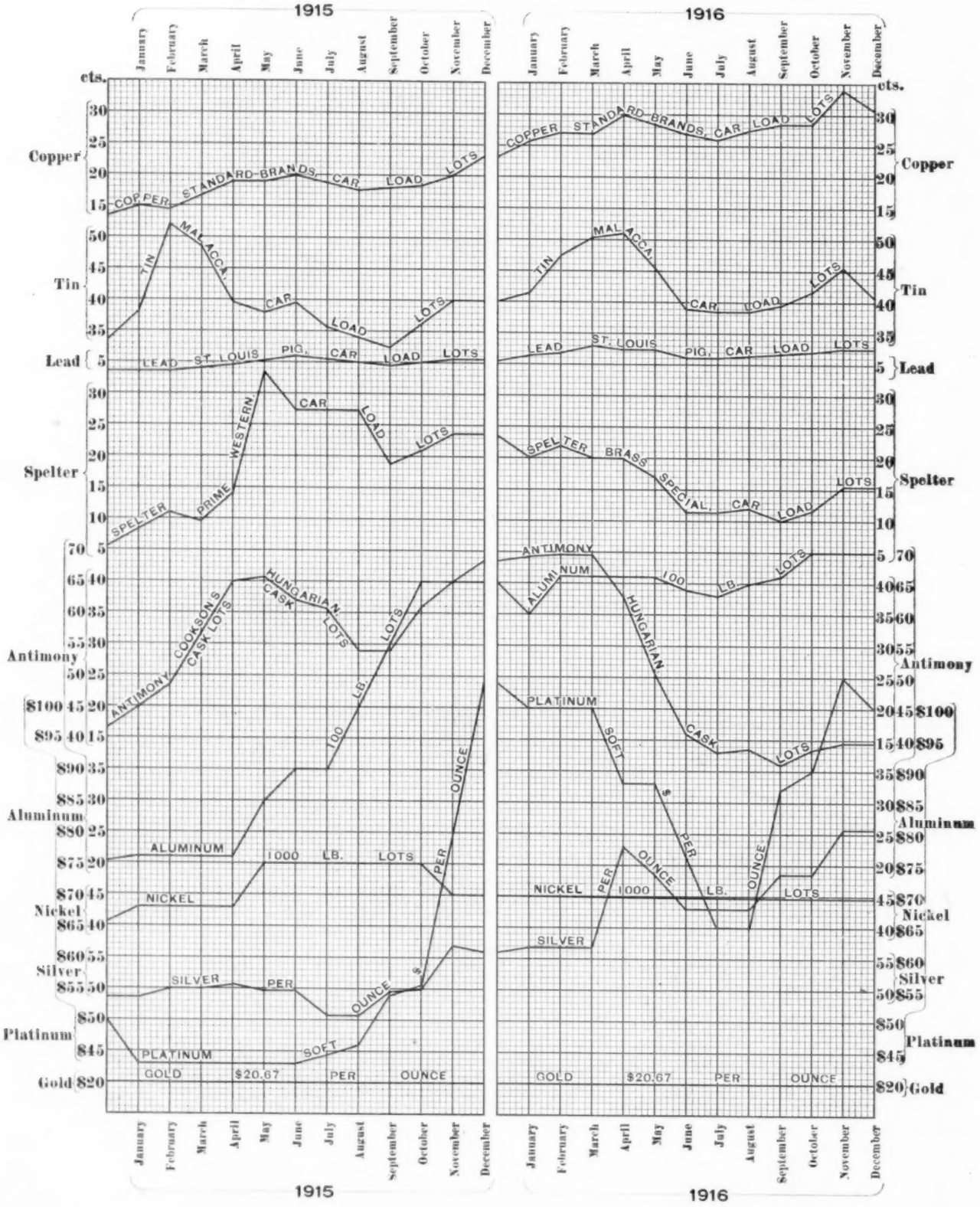
PRODUCTS. METALLIC	1913 Quantity.	1913 Value.	1914 Quantity.	1914 Value.	1915 Quantity.	1915 Value.	Products
Pig iron (spot value) long tons	30,388,935	$458,342,345	22,263,263	$298,777,429	30,384,486	$401,409,604	Pig iron
Silver, commercial value, troy ounces	66,801,500	40,348,100	72,455,100	40,067,700	74,961,075	37,397,300	Silver
Gold, coining value, troy ounces	4,299,784	88,884,400	4,572,976	94,531,800	4,887,604	101,035,700	Gold
Copper, value at New York City, pounds	1,224,484,098	189,795,035	1,150,137,192	152,968,000	1,388,009,527	242,902,000	Copper
Lead, value at New York City, short tons	411,878	36,245,264	512,794	39,998,000	507,026	47,660,000	Lead
Spelter, value at St. Louis, short tons	337,252	37,772,224	343,418	35,029,000	458,135	113,617,000	Spelter
Quicksilver, value at S. Francisco, flasks	20,213	813,171	16,548	811,680	21,033	1,826,912	Q'ksilver
Aluminum, pounds	72,379,000	13,845,000	79,129,000	14,522,700	99,806,000	17,985,500	Aluminum
Antimonial lead, short tons	16,665	1,591,854	16,667	1,572,167	23,224	3,665,736	Antim. L'd
Nickel, value at New York, pounds	481,565	79,393	845,334	313,000	1,120,556	448,222	Nickel
Tin, pounds	(k)	46,699	208,000	66,560	204,000	78,846	Tin
Platinum, value (crude) at New York City, troy ounces	1,034	46,530	6,324	280,885	8,665	478,688	Platinum
Total value of metallic products	.....	$880,745,984	.....	$678,938,921	.....	$968,505,508	

1916 ESTIMATED.

PRODUCTS. METALLIC.	Quantity.	Value Total.	Value Per Unit.
Pig iron, long tons	39,500,000	(i)	(i)
Copper, pounds	1,928,000,000	$520,000,000	$0.273
Gold, ounces, fine	4,465,807	92,316,400	20.67
Antimonial lead, short tons	21,800	4,283,000	(i)
Lead, short tons	558,200	75,915,000	(i)
Spelter, short tons	553,000	150,000,000	(i)
Quicksilver, flasks	28,942	3,643,800	(i)
Silver, ounces, fine	72,883,800	47,957,540	(i)
Nickel, pounds	(i)	(i)	(i)

(i) Figures not available.
(h) Consumption 1910-1911-1912.
(k) Small production from Alaska, South Carolina and South Dakota.

CHART OF METAL PRICES FOR 1915-1916



Metal Prices, January 10, 1917

NEW METALS.

	Price per lb.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Lake, carload lots, nominal	28.50
Electrolytic, carload lots	28.00
Casting, carload lots	27.00
TIN—Duty Free.	
Straits of Malacca, carload lots	43.00
LEAD—Duty Pig, Bars and Old 25%; pipe and sheets 20%. Pig lead, carload lots	7.60
SPELTER—Duty 15%.	
Brass Special	12.50
Prime Western, carload lots, nominal	9.90
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½ per lb.	
small lots, f. o. b. factory	72.00
100-lb. f. o. b. factory	68.00
Ton lots, f. o. b. factory	64.00
ANTIMONY—Duty 10%.	
Cookson's Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	14.50
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad valorem.	
Shot, Placquettes, Ingots, Blocks	45.00 to 50.00
ELECTROLYTIC—5 cents per pound extra.	
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	$3.50
BISMUTH—Duty free	$3.00
CADMIUM—Duty free	nominal $1.80
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	$1.50
QUICKSILVER—Duty, 10% per flask of 75 pounds	$82.00
GOLD—Duty free, per ounce	$20.67
PLATINUM—Duty free, per ounce	$80.00
SILVER—Government assay—Duty free, per ounce	75⅜c.

INGOT METALS.

	Price per lb.
Silicon Copper, 10% according to quantity	38 to 40
Silicon Copper, 20% " "	40 to 45
Silicon Copper, 30% guaranteed " "	45 to 50
Phosphor Copper, guaranteed 15% " "	40¾ to 43
Phosphor Copper, guaranteed 10% " "	39 to 42
Manganese Copper, 30%, 2% Iron " "	45 to 50
Phosphor Tin, guaranteed 5% " "	54 to 56
Phosphor Tin, no guarantee " "	53 to 55
Brass Ingot, Yellow " "	21½ to 24
Brass Ingot, Red " "	26 to 28
Bronze Ingot " "	26 to 28
Parsons Manganese Bronze Ingots " "	33½ to 35
Manganese Bronze Castings " "	32 to 42
Manganese Bronze Ingots " "	25 to 30
Phosphor Bronze " "	34 to 36
Casting Aluminum Alloys " "	42⅞ to 45

OLD METALS.

Dealers' Buying Prices.		Dealers' Selling Prices.
23.75 to 24.25	Heavy Cut Copper	27.00 to 27.50
22.50 to 23.50	Copper Wire	25.00 to 26.50
20.00 to 20.50	Light Copper	23.50 to 24.50
19.00 to 19.50	Heavy Mach. Comp	21.00 to 21.50
14.50 to 15.00	Heavy Brass	16.00 to 17.00
12.00 to 12.25	Light Brass	13.50 to 14.50
15.75 to 16.25	No. 1 Yellow Brass Turning	16.50 to 17.25
16.25 to 17.00	No. 1 Comp. Turnings	17.00 to 18.00
7.00 to 7.50	Heavy Lead	7.75 to 8.00
8.50 to 9.00	Zinc Scrap	9.00 to 9.75
20.00 to 22.00	Scrap Aluminum, Turnings	21.50 to 23.00
32.00 to 33.00	Scrap Aluminum, cast alloyed	34.00 to 36.00
42.00 to 44.00	Scrap Aluminum, sheet (new)	51.00 to 54.50
25.00 to 26.00	No. 1 Pewter	27.00 to 30.00
28.00 to 30.00	Old Nickel	32.00 to 34.00
21.00 to 23.00	Old Nickel anodes	24.00 to 26.00

PRICES OF SHEET COPPER.

Mill shipments (hot rolled) ..... 42c. base net
From stock ..... 44c. base net

SIZE OF SHEETS.		64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
Width.	LENGTH.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches	2	4	7						
	Not longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER. SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from ..... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from ..... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices ..... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices ..... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper ..... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper ..... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper ..... 1c.

Metal Prices, January 10, 1917

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect November 18, 1916.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.43	$0.44½	$0.47
Wire	.43	.44½	.47
Rod	.43	.45½	.48
Brazed tubing	.48	—	.52
Open seam tubing	.48	—	.52
Angles and channels	.48	—	.52

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.45	$0.46½	$0.49
Wire	.45	.46½	.49
Rod	.45	.47½	.50
Brazed tubing	.50	—	.54
Open seam tubing	.50	—	.54
Angles and channels	.50	—	.54

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

36c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	41c.	per lb. base
100 lbs. to 300 lbs. in one order	41½c.	" " "
Less than 100 lbs. in one order	43c.	" " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, — per lb.
Seamless Copper Tubing, — per lb.

For other sizes see Manufacturers' List.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛ ¼ ⅜ ½ ¾ 1 1¼ 1½ 2 2½ 3 3½ 4 4½ 5

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	42c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	38c.	" "
Muntz or Yellow Metal Rectangular sheets other than sheathing	43c.	" "
Muntz or Yellow Metal Rod	39½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 65c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES OF NICKEL ANODES.

85 to 87% purity	47½c.	per lb.
90 to 92% "	50c.	" "
95 to 97% "	52½c.	" "

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Base price, 60c.

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

PRICE LIST SEAMLESS ALUMINUM TUBING.

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

PRICES OF SHEET ZINC.

Duty, sheet, 15%.

	Cents per lb.
Carload lots, standard sizes and gauges, at mill	21 cent basis, less 8%
Casks, jobbers' prices	22.00
Open casks, jobbers' prices	22½

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	48½c.	10%	53c.
8%	49½c.	18%	53½c.
10%	49¾c.	20%	55¼c.
12%	51½c.	25%	63c.
15%	52c.	30%	68½c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	50c.	15%	58c.
8%	52c.	16%	58½c.
10%	54c.	18%	60½c.
12%	56c.	30%	76c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 7c. over Pig Tin. 50 to 100 lbs. 8c. over, 25 to 50 lbs. 9c. over, less than 25 lbs. 15c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3½c. above the price of bullion.

PRICES OF SOME METAL INDUSTRY CHEMICALS.

Phosphorus—Duty free, according to quantity	35c. to 40c.	per lb.
Nickel Salts, Single bbl	14c.	" "
Nickel Salts, Double bbl	11c.	" "
Sodium Cyanide	Nominal	
Silver Nitrate	53½c.	per oz.
Sodium Carbonate (Sal Soda)	.05c.	per lb.